VOLUME 116 NUMBER 5 MAY 1960

THE BRITISH VETERINARY JOURNAL

A Monthly Review of Veterinary Science

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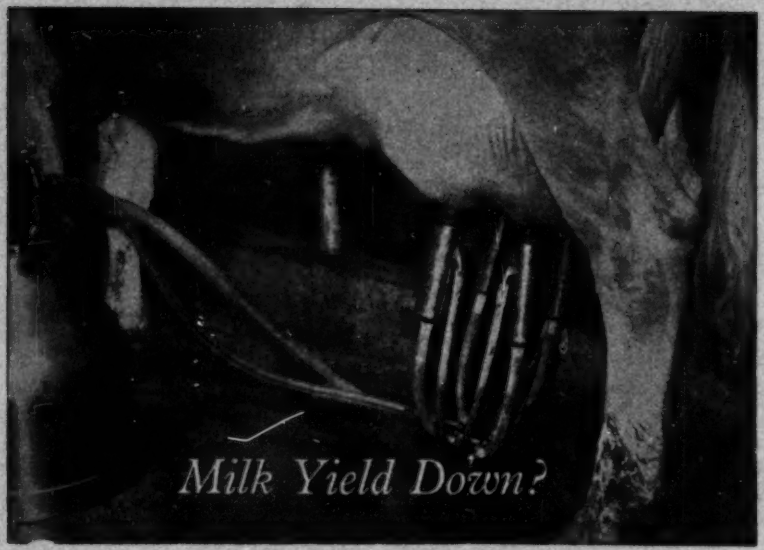

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The British Veterinary Journal

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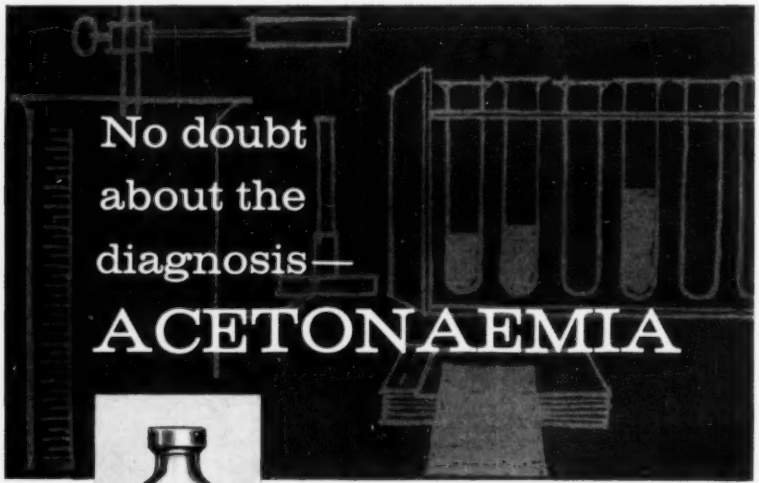

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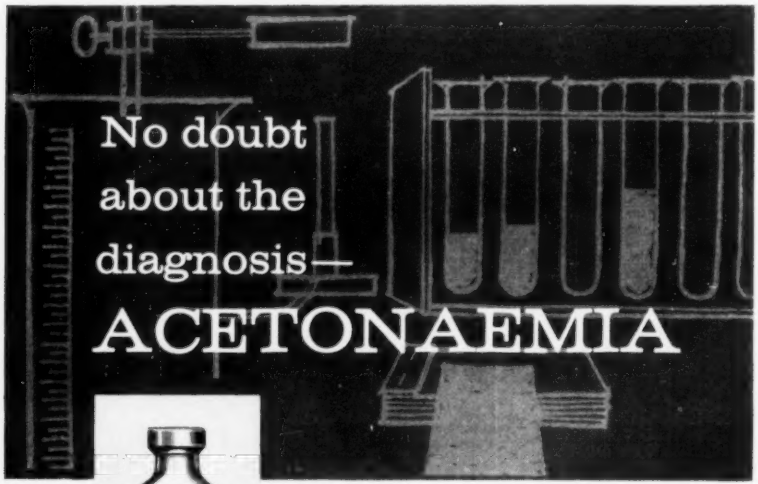

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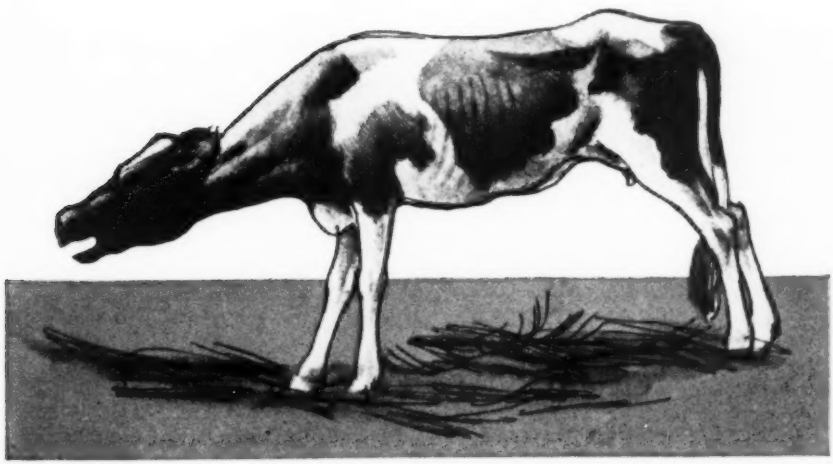

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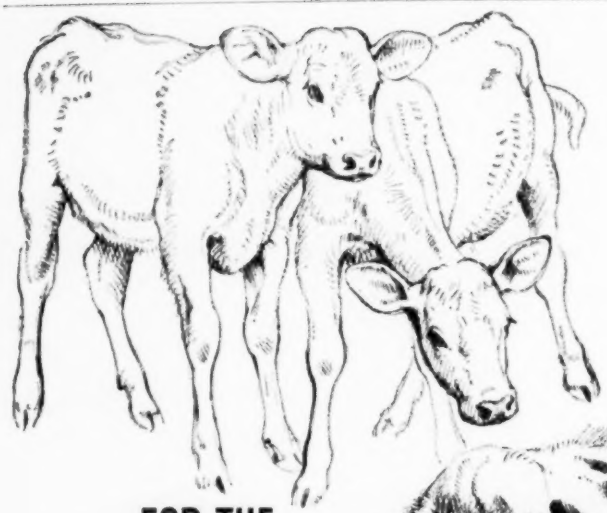

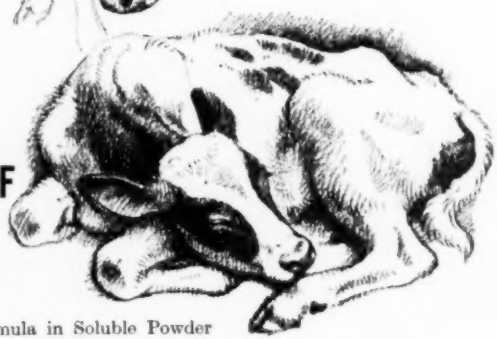

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SIR THOMAS DALLING, *M.A., D.Sc., F.R.C.V.S., F.R.S.E.*

Vol. 116 **May, 1960** **No. 5**

EDITORIAL

THOUGHTS ON THE BRITISH SMALL ANIMAL CONFERENCE

The annual congress of the British Small Animal Association was held in London during the month of March. It was the third occasion on which the members had gathered together in annual congress to review and discuss those matters of veterinary interest which are apposite to their particular branch of the profession. The congress was planned and the proceedings were organised in a most efficient manner. The programme covered a wide field, the demonstrations and discussions were interesting and stimulating, the attendance was good, the members and their visitors were presented with material to suit all tastes and they and, indeed, the profession, could not fail to profit from the occasion.

This manifestation of vitality amongst the small animal practitioners is most refreshing. For many years, in fact since the beginning of World War II, small animal practice has rested under the clouds of low status and non-importance. It has been relegated to a place " below the salt." Owing to the exigencies of war, when food production at home became a priority number one, the animals of the farm assumed an economic importance which had not been approached for twenty years. The value of individual animals increased rapidly and it became worthwhile for owners to seek professional advice and assistance rather than to have recourse to the butcher and the knacker. This led to a great increase in the calls upon the members of the profession and, in many cases, they became so busy at their tasks that time became a most important factor and, in consequence, they began to enjoy a prosperity which had been denied to them since the days of World War I.

Unfortunately the idea spread abroad and, like an acute infection, that farm animals alone were worthy of a veterinary surgeon's attention. It may be that the conception which led to the birth of this extraordinary notion was impelled by economic factors, especially after the scheme for the eradication of tuberculosis in cattle was introduced and gained full momentum. Whatever the reason, there can be no doubt that for a good many years small animal practice and, indeed, the veterinary care of all species of animals other than those of the farm, laboured

under some disregard. This pose spread even to undergraduates, many of whom have been heard to say that they did not intend to "doctor" dogs and cats. All creatures have a right to the best attention possible when they are in trouble or distress and their needs in this respect can be served best by well-trained men and women. The basic training of a veterinary surgeon is such that he can render aid to any creature in need of succour, and that aid should never be denied by one who has taken a professional oath in which he promises to dedicate his life to a cause or career. All animals are important and that importance is not measured by economic factors alone. The average dog or cat may not be worth much according to the measure of pounds, shillings and pence. In most cases their value can be assessed only by psychological standards. Long years of intimate contact with man and of faithful service have advanced dogs and cats to the status of a cherished member of the family. They share our joys, they bring comfort and sympathy to those that are ill in mind or body, they protect our property, and their loyalty reaches far beyond human standards. Whatever may be the case in other places, the household pets have become an essential part of British family life. Veterinary surgeons who devote their talents to small animal practice need not feel the qualms of lowered status. The pet animals have become a psychological necessity for the well-being of man. In these days of stress and strain they help to keep him sane, and veterinary surgeons who devote their time to the small animal branch of practice do as much good in the world as those who attend to the needs of the food-producing and working animals. The latter type of work can be achieved without sentiment and be measured almost entirely by economic rules, the former cannot be assessed by any mundane arbitrary standards, for it is born of those qualities which stem from the heart and soul.

RETROSPECT ON SOME ANGLO-AMERICAN RELATIONSHIPS IN VETERINARY MEDICINE

By

J. F. SMITHCORS, D.V.M., Ph.D.
College of Veterinary Medicine, Michigan State University, East Lansing, Michigan, U.S.A.

The ties between the veterinary professions of Great Britain and the United States undoubtedly stem from more than the common language. The ever-cordial relationships with our Canadian colleagues have served as a pleasant reminder of our mutual heritage from the beginnings of a veterinary profession on this side of the Atlantic. The term "America" has many connotations, but is used most often in the States in a somewhat provincial manner, i.e. to denote the U.S., and "American" to identify "us." Perhaps in no other field of endeavour does "American" so clearly include both Canada and the United States as in veterinary medicine. And now with the appointment of a Britisher to the editorial staff of one of our journals, it has become increasingly evident that, time-wise, London, England, is as close to many of our cities as is London, Ontario.

The contributions to the development of American veterinary medicine of British or British-trained men such as Smith, McEachran, Law and Lyman in education ; of Gamgee in epizootology ; of McLean in veterinary sanitary science ; and of Stickney, Curtis, Large and others in organised veterinary medicine are relatively well known. For many years William Youatt's works were the best to be obtained here and the *Veterinarian* was read widely before an American veterinary journal became a reality. Thus it is evident that veterinary medicine in America did not spring *de novo* from its own soil, but had roots extending to — or transplanted from — Great Britain.

Curiously enough, the one act by Great Britain which was construed by many here at the time as distinctly unfriendly had, perhaps, a more salutary influence upon the development of American veterinary medicine than any other single event. This was the embargo placed upon imports of presumably diseased U.S. cattle during the 1870s — which resulted in the establishing of sanitary veterinary medicine upon a sound basis in this country. Men like James Law, of course, recognised this action as a blessing in disguise and others were not long in following suit.

The present intention is to examine the influence upon the American veterinary profession of an unorthodox Britisher, George H. Dadd, who was truly a pivotal figure in the development of veterinary medicine in this country. This fact is not, recognised generally even at the present time. It cannot be doubted that he was far in advance of his time. Like the proverbial prophet without honour in his own (adopted) country, Dadd was for the most part ignored by the "regular" veterinary

profession. It is true that his veterinary qualifications were of dubious origin and there is no record of how much formal medical education he may have received. But when one considers the relative development of veterinary medicine in Great Britain and the United States during the period of 1850-1870, it is no disparagement of the genius of John Gamgee to make certain comparisons of these two men.

The active professional lives of both Gamgee and Dadd were brief and they have a remarkable temporal coincidence: the productive period for both began about 1855 and ended in 1868 — with the death of Dadd and the retirement of Gamgee from veterinary medicine. Both had some medical training, but Gamgee, of course, enjoyed the advantage of professional veterinary qualification — if not of professional recognition. In the latter respect, his American counterpart shared his contemporary's fate, but Gamgee at least lived to see some of his ideas adopted and he has received his just due from posterity. Both Dadd and Gamgee were well educated and wrote voluminously and well in that gray area of semi-professional literature of books intended for the laity as much as for veterinary surgeons. Both established ill-fated veterinary schools and journals and both antagonised the organised veterinary profession in their respective countries. Of Gamgee, General Sir Frederick Smith states: "He was a great man, utterly unappreciated in a country that sneered at science." Much the same could be said of Dadd.

George Dadd was born in England in 1813, but virtually nothing is known of his early life other than his admitting to having studied both human and veterinary medicine. He came to Boston as a ship's surgeon in 1846 or 1847, following which he established himself in veterinary practice — much in the manner that British surgeons had done at home a century earlier. Beginning in 1848, he produced in rapid succession a series of veterinary books in addition to his voluminous writings in the agricultural press. While his early works inevitably reflect his inexperience with animal medicine, his medical training places even these a notch or two higher than most of the veterinary books which were produced in this country at the time. His later works show that he was a gifted and facile writer on all aspects of veterinary practice. His books include:—

Chart of Veterinary Reformed Practice, Boston, 1848.
The American Cattle Doctor, New York, 1850.
Advocate of Veterinary Reform, Boston, 1850.
Anatomy and Physiology of the Horse, Boston, 1851, 1857.
The Modern Horse Doctor, New York, 1854.
Every Man His Own Cattle Doctor, New York, 1856.
Diseases and Lameness of Horses, New York, 1858.
Nature and Treatment of Diseases of Cattle, Boston, 1859.
Lameness, Boston, 1863.
Theory and Practice of Veterinary Medicine and Surgery, Boston, 1866.

Dadd also edited and published (and largely supplied the material for) the *American Veterinary Journal*, 1851-1852 and 1855-1859, but its ultimate failure might have been predicted from its meagre subscription list. Dadd states that there were only 15 graduate practitioners in America in 1846; by 1860 there

were perhaps only a hundred or so graduates and two or three hundred *bona fide* self-educated practitioners. Following the demise of his journal, Dadd served as veterinary editor of several agricultural journals in succession from 1862 to 1865, contributing many hundred pages of generally sound veterinary advice to farmers. Dadd's efforts in this area filled a distinct need at the time and he may be considered the first influential veterinary journalist in the American agricultural press. Later, James Law and other prominent veterinarians wrote extensively for the laity; in some cases, however, this was not an unmixed blessing so far as the development of professional veterinary medicine was concerned.

In addition to his extensive practice and other activities, Dadd founded the Boston Veterinary Institute in 1855. However, the idea of veterinary education was too new for this country and Dadd's school never enjoyed the patronage that Gamgee's did during its brief existence. While the Boston school ran a desultory course until 1859, the names of several of its graduates are at least a matter of record and four of Dadd's associates in the enterprise became presidents of the United States Veterinary Medical Association after its founding in 1863 (The USVMA became the AVMA in 1898). After Dadd assumed the veterinary editorship of the *Prairie Farmer* in 1863, he conducted a Veterinary Institute of Chicago for about two years, but this venture must be considered an outright failure.

Dadd's activities after 1865 are something of an enigma. In 1868 his name appears on a list of non-resident professors at the Iowa Agricultural College (now Iowa State University) as Professor of Veterinary Medicine and Surgery, but he died in Baltimore in April of that year. His sudden drop into obscurity is manifest from the fact that his death elicited only a four-line news item in the *Prairie Farmer* — the medium through which he practically established veterinary journalism as a *tour de force* in the American agricultural press. Curiously, he is credited (erroneously, of course) with having turned to other fields after this date — as Gamgee also did in 1868. One source states that "... on into the '80s, Dadd devoted a portion of his time to lecturing on temperance and was one of those who laid the foundation for the organisation of the W.C.T.U. [Women's Christian Temperance Union] ... The date of his death is unknown, but occurred sometime prior to 1890." Inasmuch as he identified himself as G. H. Dadd, Sr., during his years in Chicago, it is evident that it must have been his son that is referred to on the temperance matter.

Not of least importance is the fact that Dadd was the first American veterinary surgeon to use general anaesthesia as a regular adjunct to practice. In his writings he advocates a mixture of ether and chloroform for all painful operations and he describes its use in a number of cases. He is credited also with being the first here to spay a mare successfully and to perform the cesarean operation in swine — at least with any regularity and success. His penchant for advertising and often his caustic pen undoubtedly robbed him of professional recognition, but in these matters a number of prominent practitioners of the time were not above reproach.

Gamgee, of course, had no peer in the field of epizootology, and — as is so

often the case with a true pioneer — he had to fight his battles alone. Dadd, while hardly to be classed as an epizootologist, had the good fortune to be associated with E. T. Thayer, the eminent veterinarian who for many years headed the Massachusetts Cattle Commission. Thayer is credited with eradicating contagious pleuro-pneumonia in his State and keeping the State clean for 25 years while the disease raged in nearby States. Dadd, who assisted with investigations of the disease in 1859, writes: "... the contagious element of this disease is established beyond the possibility of a doubt ... It appears to me that this malady is not only a matter of grave importance to the people of North Brookfield [Mass.]; the interests of the husbandmen of the whole of North America are involved." In both Britain and America, at this time, the contagious nature of the disease was poorly understood — or openly disputed — by many whose opinions were considered authoritative.

Gamgee railed at the inadequate measures for handling the epizootic in Britain and was properly indignant over the marketing of meat from diseased animals. While there is no evidence that Dadd had much to do with the prompt slaughter programme initiated in Massachusetts, he was "of the opinion that every animal in North Brookfield will eventually have to be killed and could this be done at once the advantage is obvious." Moreover, people "in Boston and elsewhere need not feel alarmed lest the diseased meat should be offered for sale in their several localities, for ... it is almost a matter of impossibility to get a dead carcase beyond the limits of this town."

Despite the brilliant record of Massachusetts in handling the disease, other States temporised with it until the British embargo on U.S. cattle forced the issue. At the time it is most improbable that either Britain or the U.S. detected the fine hand of John Gamgee in the sequence of events responsible for this act. Had it not been for this embargo, we might well have temporised the U.S. cattle industry out of existence.

Gamgee, of course, did more than write on animal disease and run a school. Sir Frederick states: "One of the objects for which Gamgee struggled throughout his professional life was a better and higher veterinary training in the schools. He realised that the position of the profession in the future depended upon its members having the same acquaintance with science as the general practitioner in medicine who earned the respect and gratitude of those amongst whom he lived." Gamgee's short-lived venture into veterinary education was based upon the premise that more training in epizootic diseases was essential, and while he was not to enjoy the fruits of his teaching, Americans were given these benefits through his protégé and associate, James Law. It was Gamgee who recommended Law as the first Professor of Veterinary Medicine at Cornell University in 1868. Law, of course, soon established himself as a leading educator and veterinary sanitarian and like several of Dadd's associates was accorded the presidency of our national association.

On the need for veterinary education of the highest type, Dadd urges in 1850 — in a vein that sounds much like John Hunter — "The object of the veterinary art is not only congenital with human medicine, but the very same paths that lead

to a knowledge of the diseases of man lead also to a knowledge of those of brutes. Our domestic animals deserve consideration at our hands. We have tried all manner of experiments on them for the benefit of science ; and science and scientific men should do something to repay the debt by alleviating their sufferings and improving their condition . . . We advocate the establishment of veterinary schools and the cultivation of our reformed system of veterinary medicine on the broad principles of humanity."

As a veterinary educator, it must be acknowledged that Dadd had little influence insofar as the immediate results of his efforts are concerned. While Gamgee's school prospered during its brief existence and might have been even more successful had not Gamgee been plagued with other matters, his major problem was quite the opposite to that of Dadd's. Gamgee had to fight the resistance of an established profession ; Dadd had to fight the apathy of an unsympathetic public. And the lack of overt opposition by the " regular " veterinary profession did not necessarily make his task the easier — in a sense, he had no antagonists to face. Generally speaking, for men with the courage of their convictions — as demonstrated by both Gamgee and Dadd — more is to be gained by having an enemy who will fight in the open. At least, when the fray is over the rewards — even in defeat — are more likely to accrue to him who has been able to identify his antagonist and face him squarely, as Gamgee did in no uncertain terms.

William Hunting says of Gamgee: " His life did not fulfil its promise . . . He was twenty years in advance of his age and his schemes and ideas had to be taught to people . . . His life was fruitful to all—except himself." It might be observed, however, that no intelligent protest is in vain and, had Gamgee cared to exult over it, he at least lived out his " twenty years " to see his ideas put into practice. Posterity accords him his just due. Dadd's professional career ended with his death. He did not have the satisfaction of seeing — in the next twenty years — the establishment of sound veterinary schools, a professional veterinary literature and the beginnings of an efficient veterinary sanitary service. History has not recognised him for what he was: a pivotal figure in American veterinary medicine.

The facts of George Dadd's professional life, when interpreted in the light of more modern medical historiography, give us an adequate picture of his contributions to veterinary medicine, i.e. interpretations based upon the contemporary situation rather than in the light of what is good or bad today. Perhaps largely because he worked outside the realm of what was accepted as the veterinary profession of his time, the treatment he has been accorded by later observers is generally inadequate and unjust. About the best that has been said of him is that: ". . . he condemned in unmeasured terms the cruel practices of the unqualified veterinary practitioners of the day. In this he lived up to the best traditions of the veterinary profession." Another characterises him as: ". . . a man completely dedicated to veterinary medicine . . . far in advance of his time." But another credits him with being little more than ". . . an interesting and colourful character."

As something of a study in contrast, a composite of Sir Frederick's evaluation leaves us with the convincing conviction: " John Gamgee was a genius . . . gifted

beyond measure . . . a man to whom all knowledge appeared to come without effort, with an immense capacity for storing learning denied the ordinary mortal . . . He was a great man, utterly unappreciated [but] in the long run Gamgee's recommendations had to be adopted . . . Such can be the only verdict of posterity."

To what extent Dadd's concept of the position veterinary medicine should occupy in this country was influenced by his British heritage is perhaps a moot point. Certainly, his theory and practice was in advance of that which generally obtained here at the time and reflected many of the better features of contemporary British thinking. This is particularly true with respect to his urging of a more scientific attitude towards the handling of animal disease — as proclaimed with even greater intensity by John Gamgee. And in his urging of a more rational and humane attitude toward animals as individuals, Dadd reflected the generous sentiments of William Youatt and the increasing numbers of British veterinary surgeons whose yeoman efforts on behalf of professional veterinary medicine are sufficiently well known to not need recounting. Posterity has accorded John Gamgee his rightful place ; further retrospect may give George Dadd his just due.

In summary, it seems evident that the generally greater development of the veterinary profession in Great Britain during the latter part of the 19th century had more profound repercussions in America than is usually conceded. In the upper echelons a status more nearly approaching equality obtained, but that much of the advanced thinking here was by British or British-trained men should perhaps receive greater consideration. Both countries have the dubious distinction of having ignored some of the best thinking that was applied to major problems of the time.

CHEMICAL AND PAPER ELECTROPHORETIC ANALYSIS OF NORMAL SHEEP SERUM PROTEINS AND LIPOPROTEINS

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The separation of the serum proteins and lipids by paper electrophoresis and their subsequent identification have been found to be of much interest both in the clinical diagnosis and in research. Deutsch and Goedloe (1954) and Chopard (1954) investigated the protein distribution in the blood of various animals including sheep. The former examined the plasma proteins of five sheep using the moving boundary electrophoresis. They stated that the only component evaluated with accuracy was the albumin fraction. On the other hand, the values obtained by Chopard by paper electrophoretics show a very wide range. No mention is made, however, of age groups and no differentiation is made between sex groups. Kuttler and Marble (1959), in their study on the effect of freezing and storage on serum proteins, reported five protein fractions in the normal lamb serum. To the authors' knowledge, paper electrophoretic analysis on normal sheep serum lipoproteins does not seem to have been carried out.

In the present work, investigations of serum proteins, lipoproteins, and their distribution in normal sheep were carried out. In order to find out about the physiological changes that take place during maturing, animals of different ages and from both sexes were investigated. Furthermore, serum samples from different breeds of sheep were included.

Materials and Methods

A total of 55 animals was examined, 42 of them belonging to the fat-tailed Awassi breed and 13 to various other breeds (see Table 5). The Awassi sheep were divided into seven groups of 6 animals each, as follows:—

Group A—Ram lambs, 3 months old.
Group B—Docked lambs, 3 months old.
Group C—Ewe lambs, 3 months old.
Group D—Ram lambs, 10-12 months old.
Group E—Ewe lambs, 10-12 months old.
Group F—Rams, about 3 years old.
Group G—Ewes, 3 years old, in full lactation.

Docking of the fat tail of the lambs in Group B was performed three days after birth. The animals used in this experiment were clinically healthy and housed under similar conditions. Blood samples were obtained after 14 hours of fasting. Total protein, albumin and globulin determinations were carried out by the modified biuret method of Kingsley (1940), as modified by Weichselbaum (1946).

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The paper electrophoretic analysis was performed in a horizontal type chamber ; Michaelis buffer (sodium barbiturate, sodium acetate and HCl)—pH 8·6, ionic strength 0·1 μ was used, and Whatman No. 1 filter paper served as carrier. Two serum samples from each animal were run for 16 hours, with a field strength of 4·5 V per cm., with 2 milliamp., for a strip of 4 cm. width. The protein bands were dyed with naphthalene black, the lipoproteins with sudan black ; and both were estimated densitometrically, followed by planimetration.

Results

In Table 1, we present the values for total protein ; for albumin and globulin and their ratio ; and also their respective standard deviation for the seven serum groups of Awassi sheep. It should be pointed out that with increasing age, the total serum proteins rise in both sexes, without significant differences between male and female groups—from 5·65 g./100 ml. serum recorded in the three-month old ram lambs to 6·95/100 ml. in the yearlings and to 7·02 in the three-year old ram lambs ; the corresponding rises in the female group are, per 100 ml. serum—5·78 g. (three-month old ewes), 7·12 g. (yearling ewes), and 7·36 g. (lactating ewes). Even when taking into account the standard deviation, there is no overlapping of the values between the three-month old groups and the older ones. The increased total protein values obtained are due to the rise in the globulins. This is especially pronounced in the sera of the lactating ewes. Thus, the albumin/globulin ratio dropped with higher age from 1·85 in Group A to 0·19-0·90 in Group D and E, respectively. In the female groups, this drop is from 1·75 in Group C to 0·99 in Group E, and to 0·77 in the lactating ewes group.

The paper electrophoretic ovine serum pattern shows the same trend in the albumin/globulin distribution. As seen from Tables 2 and 3, seven paper-electrophoretic fractions were observed.

In order to facilitate the identification of the various fractions in the sheep sera, samples of normal human serum and of sheep serum were run simultaneously on the same strips. After staining, the human sample showed the familiar six-band pattern, while the sheep sera exhibited a number of sub-fractions of the various main fractions (see Fig. 1).

The sheep serum albumin is homogenous, but the alpha globulins show three distinct fractions: The alpha-1 globulin with the same mobility as in the human serum ; the alpha-2 globulin migrating slightly slower than the human alpha-2 ; and the alpha-3 globulin being more pronounced and having a larger mobility than the human serum alpha-2 globulin. In sheep, there are two beta globulin fractions, namely, the usual beta-1 and the beta-3, found by Boguth (1953, 1954) in different animals, and by the authors (Perk *et al*, 1958) in chickens and geese.

The gamma globulin of sheep corresponds in mobility to that of human serum. These patterns change slightly when the sera of the three first groups (lambs) are compared to the four others (mature sheep). In the latter instance, the beta-globulin has no subfraction ; while the gamma globulin splits into two, gamma-1 and gamma-2 globulins.

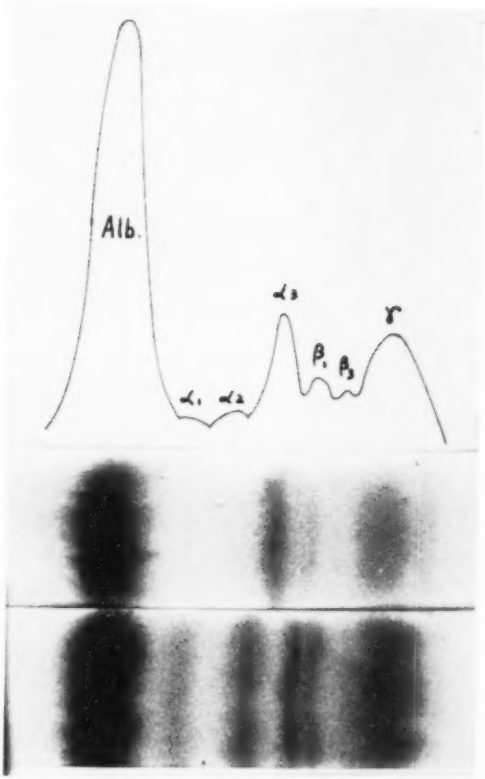

FIG. 1

Electrophoretic serum protein pattern obtained from normal Rambouillet lamb, three-month old (above) (S); normal human (below) (H).

(*Article by Perk and Lohl, page 167*)

TABLE 1.

Mean Values of Serum Proteins (in g. per 100 ml. serum) and their Standard Deviation (Chemical Determination).

Groups	*No. of Animals*	*Total Protein*	*Albumin*	*Globulin*	*Alb/Glb*
A. Ram lambs (3 months old)	6	5·65 ± 0·41	3·67 ± 0·18	1·98 ± 0·25	1·8
B. Docked lambs (3 months old)	6	5·92 ± 0·29	3·83 ± 0·24	2·08 ± 0·13	1·8
C. Ewe lambs (3 months old)	6	5·78 ± 0·31	3·70 ± 0·23	2·08 ± 0·26	1·7
D. Ram lambs (10-12 months old)	6	6·95 ± 0·25	3·32 ± 0·21	3·63 ± 0·14	0·91
E. Ewe lambs (10-12 months old)	6	7·12 ± 0·27	3·55 ± 0·23	3·57 ± 0·26	0·99
F. Rams (3 years old)	6	7·02 ± 0·32	3·32 ± 0·24	3·70 ± 0·25	0·90
G. Lactating Ewes (3 years old)	6	7·36 ± 0·24	3·20 ± 0·19	4·16 ± 0·22	0·77

TABLE 2.

Serum Protein Paper Electrophoretic Pattern in Percentages of the Protein and their Standard Deviation.

Groups	*Albumin*	*alpha-1*	*alpha-2*	*alpha-3*	*beta-1*	*beta-3*	*gamma-1*	*gamma-2*
A. Ram lambs (3 months old)	60·3±0·94	2·3±0·37	4·0±0·57	10·8±0·47	6·5±0·93	5·2±0·38	11·0±1·0	—
B. Docked lambs (3 months old)	61·3±4·05	2·4±0·53	3·8±0·69	11·6±2·1	4·6±1·34	3·0±0·29	13·3±2·5	—
C. Ewe lambs (3 months old)	61·7±3·13	2·5±0·41	3·5±0·46	10·7±1·6	5·6±0·91	4·0±0·31	11·6±1·10	—
D. Ram lambs (10-12 months old)	46·9±3·46	3·1±0·37	3·7±0·38	9·4±0·45	5·9±0·11	—	22·9±2·4	7·8±1·7
E. Ewe lambs (10-12 months old)	46·7±2·67	4·0±1·04	4·6±1·17	9·6±1·09	6·2±0·9	—	21·8±2·37	6·8±1·34
F. Rams (3 years old)	46·8±2·51	3·0±0·92	3·7±0·98	9·0±0·81	6·6±0·9	—	23·1±2·10	7·8±1·03
G. Lactating Ewes (3 years old)	41·7±2·07	3·1±0·31	4·0±0·31	7·5±0·61	7·5±0·53	—	25·5±1·9	10·6±1·3

At the age of three months, there are no significant differences between the values of the different fractions for ram lambs, docked, and ewe lambs (Table 2). But when we compare the 3-month old ram lambs with the older males, we observe the following changes: The relative value for albumin drops from about 60 per cent. of the total to 46 per cent. in the older groups. There is also a reduction in the alpha-3 globulin, but far less pronounced. The alpha-2 and beta-1 globulins show no significant differences, while the beta-3 on the other hand, is absent in the older groups. Two fractions exhibit a rise in their relative values in the sera of the older rams; alpha-1 globulin shows only a slight rise (from 2·3 to 3·1), while the gamma globulin rises from about 11 per cent of the total in the three-month old rams to 23 per cent. in the older rams. This rise is even more pronounced when you consider the 6·8 per cent. of the gamma-2 in the older groups. This fraction is not present in the three-month old rams.

The female groups show the same trend. In lactating ewes, the changes are more marked. The albumin has been reduced to 41 per cent. as compared with the 61 per cent. of total proteins in the 3-month old ewe lambs; and the combined gamma globulins in the lactating ewes rises from 11 per cent. in the young ewes to 36 per cent. in the older ones.

There are no significant differences in the values for the protein fractions of both sexes in the 10-12 month old sheep or in the 3-month old sheep. The lactating ewes however, have a lower albumin value; but they have a significantly higher gamma-globulin value as compared with the results in rams of the same age.

Table 3 summarizes the protein pattern in absolute values, obtained from the seven groups (g. per 100 ml. serum).

While generally a close link exists between the relative values (in percentages) and the absolute values (in g./100 ml. serum), there are, nevertheless, some changes evident when we compare these two groups of values (Tables 2 and 3). The albumin, in terms of relative values, differs by about 25 per cent. when comparing the younger with the older groups; while in terms of absolute figures (g./100 ml. serum) the drop is far less pronounced. The slight rise in relative values for alpha-1, when "translated" into absolute values, is a rise of about 40 per cent. The same happens with regard to the beta-1 globulin; while in terms of relative values there is very little difference in the various groups for beta-1, the corresponding absolute values show a definite increase in the older groups. Thus it becomes evident that results should be evaluated on the basis of relative as well as of absolute values.

When comparing the absolute values (g./100 ml. serum) obtained by chemical determination with those obtained by paper electrophoresis, we observe that the latter ones show consistently lower values for the albumin. According to Machenboeuf (1949) and Wuhrmann and Wunderly (1957), part of the alpha globulins are always found with the albumin by the salting-out methods. In the paper electrophoretic method the albumin is completely dissociated from the globulin fractions; it is clear therefore that this latter method yields lower but accurate values for the albumin expressed in absolute values.

TABLE 3.

Paper Electrophoretic Pattern in Absolute Values (g. per 100 ml. serum).

Groups	Total Protein	Albumin	alpha-1	alpha-2	alpha-3	beta-1	beta-3	gamma-1	gamma-2
A. Ram lambs (3 months old)	5·65	3·50	0·13	0·22	0·61	0·37	0·29	0·62	—
B. Docked lambs (3 months old)	5·92	3·64	0·14	0·25	0·61	0·27	0·18	0·79	—
C. Ewe lambs (3 months old)	5·78	3·56	0·14	0·20	0·62	0·33	0·23	0·67	—
D. Ram lambs (10-12 months old)	6·95	3·26	0·22	0·26	0·65	0·41	—	1·59	0·54
E. Ewe lambs (10-12 months old)	7·12	3·34	0·30	0·29	0·68	0·45	—	1·56	0·49
F. Rams (3 years old)	7·02	3·28	0·21	0·26	0·64	0·46	—	1·62	0·55
G. Lactating Ewes (3 years old)	7·36	3·07	0·23	0·29	0·55	0·55	—	1·88	0·78

TABLE 4.

Serum Lipoprotein Distribution in Percentages and their Standard Deviation.

Groups	Albumin	alpha	beta	gamma
A. Ram lambs (3 months old)	50·2±2·67	18·3±3·14	9·3±2·13	21·0±3·47
B. Docked lambs (3 months old)	50·8±3·12	19·3±2·67	11·1±1·03	18·6±1·96
C. Ewe lambs (3 months old)	49·5±4·10	20·8±2·96	11·6±2·56	18·0±2·05
D. Ram lambs (10-12 months old)	44·8±1·97	19·3±2·12	19·7±2·01	16·1±2·02
E. Ewe lambs (10-12 months old)	43·4±2·49	19·3±1·79	19·7±0·56	17·5±1·80
G. Lactating Ewes (3 years old)	39·4±3·12	22·0±2·10	22·6±1·30	15·8±1·96

TABLE 5.

Serum Proteins and their Paper Electrophoretic Distribution, obtained from Various Breeds of Sheep (Rams only)

							Protein distribution in percentage Globulin fractions						
			Proteins in g./100 ml. serum					*Alpha*			*Beta*		*Gamma*	
Breed	*Age*	*No.*	*T.P.*	*Al.*	*Gl.*	*Al./Gl.*	*Albumin*	*1*	*2*	*3*	*1*	*3*	*1*	*2*
Awasi	10 years	1	6·6	3·2	3·4	0·94	49·5	2	3·5	6·5	7·5	—	25	6
Rambouillet	3 months	3	6·0	3·8	2·2	1·73	69	2	2	7·5	3·7	2·2	13·2	—
Rambouillet	1 year	1	6·1	2·9	3·2	0·91	46	1·5	2	4	8·5	5	27	6
Rambouillet	6 years	1	6·5	3·1	3·4	0·91	47·5	1·5	4	7·5	8	—	23	8·5
Corriedale	1 year	1	6·1	2·9	3·2	0·91	49	2	2·5	4	9·5	4·5	22	6·5
Corriedale	6 years	1	6·1	2·9	3·2	0·91	49	2·5	3	3·5	8·5	5	21	7·5
Karakul	6 months	2	5·8	3·0	2·8	1·07	50	2·5	4	10	5	6	22·5	—
Somali	1 year	1	6·6	3·0	3·6	0 83	44·5	2	3·5	8·5	8	—	26	7·5
East Friessian	1 year	1	6·1	2·8	3·3	0·85	49·5	2	3·5	6·5	7·5	—	25	6
Romney Marsh	8 years	1	8·7	4·0	4·7	0·87	47	1·5	3	9	7	—	21	11·5

TABLE 6.

Serum Lipoprotein Distribution in Percentages, obtained from Various Breeds of Sheep (Rams only).

Breed	*Age*	*No. of Animals*	*Albumin*	*alpha*	*beta*	*gamma*
Awasi	10 years	1	45·2	19·8	18·5	16·5
Rambouillet	3 months	3	57·4	14	10·6	18
Rambouillet	1 year	1	45	16·5	19	19·5
Rambouillet	6 years	1	46	17·5	18	18·5
Corriedale	1 year	1	44	19	20·5	16·5
Corriedale	6 years	1	44·5	18	20·5	17
Karakul	6 months	2	48·2	20	14	17·8
Somali	1 year	1	47	18·5	16·5	18
East Friessian	1 year	1	42·5	15·5	23	19
Romney Marsh	8 years	1	41·5	19·5	24·2	14·8

The paper electrophoretic lipoprotein pattern of the sheep serum shows 4 distinct bands: One of them is situated in the albumin region containing about half of the stainable lipoproteins; the second contains about 20 per cent. and is situated in the alpha-2 globulin region; the third band displays a mobility between the beta-1 and beta-3 globulin; and the fourth band extends from the origin to the beta-3 globulin. Consequently, these bands will be referred to as albumin, alpha, beta, and gamma lipoproteins. The results obtained are presented in Table 4. From this Table, we see that with increasing age the lipoproteins from the albumin region decrease; this decrease is most distinct in lactating ewes (from 49·5 per cent. in three-month old lambs to 33·4 per cent. in lactating ewes).

The alpha lipoproteins show practically no change except in the case of the lactating ewes where a slight increase is recorded. The most striking differences occur in the beta lipoproteins. There, an increase occurs of about 40 per cent. when comparing the 3-month old sheep with the yearlings, and of 100 per cent. when comparing the 3-month old to the lactating ewes.

At the same time, the lipoprotein bound to the gamma globulin decreases by about 15 per cent. in the lactating ewes.

Discussion

In veterinary literature we find reports on the increase of total serum proteins with increasing age in animals (Witschi, 1959; Lawson, 1959; Perk and Lobl, 1959; Becker and Smith, 1950). The present investigation shows that this increase is accounted for mainly by the rise of the globulins in the sheep blood serum, especially in the beta and gamma globulins (in absolute values). The beta globulins, serving mainly as a vehicle for the lipoproteins, thus rise simultaneously with the beta lipoproteins which increase in the older sheep. The same phenomenon has been noted in humans, where beta lipoproteins increase with advancing age (Keys *et al*, 1950).

However, the most remarkable rise of proteins with increasing age is encountered in the gamma globulin fraction. With advancing age, the animals are exposed to various antigenic agents, resulting in an increase in the immune globulin production. The immune globulin, being part of the gamma globulin complex, naturally leads to an increase in this fraction with advanced age. The fact that all these changes are still more pronounced in the lactating ewes, might be related to the endogenous female hormone secretion. In former investigations (Perk and Lobl, 1958, 1959) it was shown that increased female hormone levels (either endogenous or induced) in chicken, geese and cattle give similar results.

The results of the present study contradict those found by Howe (1925) and cited by Dukes (1957). There it is stated that the albumin/globulin ratio in sheep is greater than 1. These findings have been confirmed by the results obtained with 3-month old lambs (Awassi, Rambouillet)—but, in older and mature sheep, the albumin/globulin ration is *less* than 1. Both chemical and paper electrophoretic analyses confirmed these results. Thus, a certain restraint in generalizing seems indicated. In similar studies, age and status should be stated clearly.

Samples of different breeds were investigated also. This was done in order to find out whether there are significant differences in the paper electrophoretic patterns. Tables 5 and 6 indicate that there are no marked differences between the values of different breeds after the age of one year. The samples from sheep which happened to be under one year (3 Rambouillets, 3 months old and 2 Karakuls, 6 months old) exhibit the same high albumin/globulin ratio as found in Awassi lambs of the same age. We find also a high relative value for albumin and a low value for the gamma globulin, particularly in the younger group.

Summary

An investigation of serum proteins and lipoproteins in the sera of sheep of different age groups and of both sexes was conducted. Total serum proteins increased with age. The paper electrophoretic protein pattern shows seven fractions. By this method it has been revealed that the increase in the total protein is chiefly due to increased alpha-1, beta-1 and gamma globulins. The paper electrophoretic lipoprotein pattern shows 4 stainable regions. The changes occurring with advanced age result in a decrease in the albumin region and an increase in the beta lipoprotein fraction. The increase in beta globulin is related to the increased beta lipoproteins. The increase in gamma globulins is due to the increase in immune globulin production.

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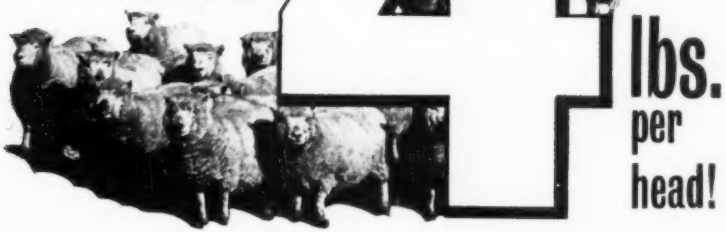
N. IRELAND MARGINAL AREA TRIALS RESULT IN 'PERMACO'-DOSED LAMBS GAINING extra 4 lbs. per head!



A Farmer & Stockbreeder photograph

Two experiments* conducted in Mourne and Antrim, Northern Ireland, for the purpose of studying the effect of cobalt bullets on the live-weight of lambs, have resulted in the cobalt-treated groups making greater weight gains than the controls. In both trials the extra gains averaged more than 4 lbs a head despite the fact that there is *no marked deficiency of cobalt in either area.*

MOURNE AREA

Symptoms of cobalt deficiency reported

The first trial was on a County Armagh farm in the Mourne area, where the owner had suspected cobalt deficiency. The soil in this area is of granitic origin and has a lower cobalt content than most other soils in N. Ireland. In this experiment, in which 36 Greyface lambs were treated and 36 more retained as controls, the treated lambs gained, in twenty weeks, 4.6 lbs more than the untreated.

ANTRIM AREA

Soil of relatively high cobalt status

The second trial was on a hill farm in County Antrim where the soil, basaltic in origin, has *a relatively high cobalt content.* Here, 60 Greyface lambs were divided into two groups and *after three weeks* the treated lambs had gained 2.5 lbs more than the controls. At eleven weeks the average difference had increased to 4.3 lbs.

Cobalt treatment produces "superior" lambs

The report of the trials states that since no marked deficiency of cobalt has been found in either area "... these results suggest that marginal deficiencies of cobalt do occur, and this is strengthened by the fact that physically the treated lambs were much better specimens with superior fleeces than the lambs which received no cobalt pellets."

Use of Cobalt Bullets "economically sound"

The report concludes: "At present day prices for fat lambs the use of cobalt pellets on these lambs was economically sound, since an outlay of 1s. 6d. per pellet resulted in an increase of about 2 lb. carcass weight worth about 5/-, to which must be added the heavier fleece."

**Gracey, J. F., Todd, J. R., (1959), Brit. Vet. J. 115 (10), 359-364.*

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PATHOLOGY OF THE CETACEA
A VETERINARY STUDY ON WHALES—Part II

W. ROSS COCKRILL, Dr.vet.med.(Zurich), F.R.C.V.S.
Food and Agricultural Organisation, Rome.

Traumata

Frequently traumatic lesions are observed in whales of all species (Loth, 1931 ; Slijper, 1931, 1936). The most common, and the most spectacular, of these are old harpoon wounds. Not every hunted whale is killed: not every whale hit with a harpoon dies as a result. Healing of the wounds caused by the explosive-head harpoon results in large areas of cicatrization. The whale possesses, in remarkable degree, the power of forming rapidly, and in great amount, a white, hard, fibrous, connective tissue. Any external wounds, and a large proportion of internal lesions, induce the massive formation of this tough fibrous tissue. Regeneration of existing tissue does not take place and there is a fibrous tissue replacement of the damaged areas. It is difficult to convey in words the extent of harpoon damage in a wounded whale (Fig. 7). It penetrates through the blubber and deeply into the muscle layers. Following the explosion pieces of metal, sometimes several kilograms in weight, plough furrows through the living tissue.

In a Blue whale in the Ross Sea area a very extensive old wound involving the left flipper was observed by the writer. The wound had been very wide and deep, and contained many shattered fragments of bone. The shoulder joint was involved and only partial and incomplete movements of the crippled limb can have been possible. The superabundant formation of dense fibrous tissue was a remarkable feature of the healing process. There was no evidence of suppuration, and healing appeared to be complete. On the surface the healing tissue had been produced lavishly and irregularly, so that the flipper and the surrounding area were characterized by large, irregular protuberances of replacement tissue.

The commonest site for harpoons is the back region (Fig. 8) and often damage to the Longissimus dorsi and Psoas muscle groups is very extensive. Whenever possible, a skilful gunner will choose a target area slightly below and posterior to the pectoral fin, with the intention that the harpoon shall enter the thoracic cavity. Then damage to the lungs and heart is extensive. The thorax fills rapidly with blood ; invariably in the last stages of the struggle a mortally-wounded whale will be seen to exhale a scarlet mist, and then death follows quickly.

Often the blubber of the back region, posterior to the blow-holes, is seen to be ridged and grooved, and to exhibit furrows of fibrous connective tissue. Such lesions are attributed to ice damage. It is said that sometimes whales will surface under pack ice and attempt to force their way to the air through the hard and jagged ice.

For a number of years whales have been subjected to marking in a series of long-term experiments designed for the acquisition of information concerning

their migratory movements and age. The method of marking is to shoot a small, pointed, stainless-steel tube into the blubber, and this work has been carried out by various research vessels in Antarctic waters over many seasons (Hardy, 1940; Brown, 1954). Each dart bears a serial number, the date and exact position when it was fired being known. Instructions are engraved on the metal concerning the recording of the approximate position and the time of recovery of the dart, and the species of whale from which it was recovered. A reward is offered for the darts together with the desired information, and many of them have been recovered from whales at shore locations and on the floating factories.

The blubber lesion is generally so small as to be negligible. The dart becomes invested and isolated by abundant connective tissue. Sometimes there is evidence of pus formation. In the operation of flensing, many of these darts are overlooked and subsequently their remnants are found in the factory machinery when they cannot be related to any individual whale carcass. Nevertheless a steady flow of information on migratory movements is being gained, and the hunting and marking of a wide variety of whales of all ages in the Antarctic is being continued.

Other traumata to be observed are the scars on the head of every Sperm whale caught in the Antarctic grounds (Fig. 9). These white lines cover the enormous head and spread down and around the jaws. They are attributed to damage caused by the hooks and suckers on the tentacles of the large octopods, and possibly also by the "beak" of the cuttlefish, on which the Antarctic Sperm whale principally feeds. Titanic struggles are visualized in the depths of the ocean in which the whale, in its efforts to kill its struggling victim, itself sustains considerable damage. Of the many Sperm whales taken both in the Ross Sea and the Weddell Sea the writer has never observed any recent wounds on the head region, even of whales taken in the areas of the Banks which are regarded as the best feeding grounds, and where the stomach of the whale is often impacted with ingested cuttlefish sometimes of notable size and usually freshly taken.

The deformities of the lower jaw of the Sperm whale caused either by such fights in the constant struggle for existence, or by encounters with their own kind, have already been mentioned and are well known to all who have taken part in the Sperm fishery. "Not a few are captured having the deep scars of these encounters — furrowed heads, broken teeth, scalloped fins; and, in some instances, wrenched and dislocated mouths" (Melville, 1851). It appears possible that the head scars noted in the Antarctic Sperm whales — which are, without exception, old and solitary males — are more likely to be evidence of such encounters in previous times than of tentacle wounds sustained in Southern waters.

Caries in the maxillary teeth of Sperm whales has been reported by Pouchet and Beauregard (1889), Moodie (1923), Freund (1932), Colyer (1936), and Boschma (1938). Various deformities of the teeth are common. The pulp cavity is often found to be filled with a hard pearly deposit of osteodentine. Abrasion of a tooth surface, and absorption of tooth tissue are seen occasionally. The latter occurs below the level of the gum and is initiated by abscess formation arising from an inflammatory process of the periodontal membrane. One such case was noted by the author in a Sperm whale in the Ross Sea area (Fig. 10). An extensive zone

FIG. 7

Harpoon in position in the Longissimus dorsi muscle of a Fin whale, illustrating the extensive damage caused by the explosion of the grenade. The blubber has been removed. *(Photo W. R. C.)*

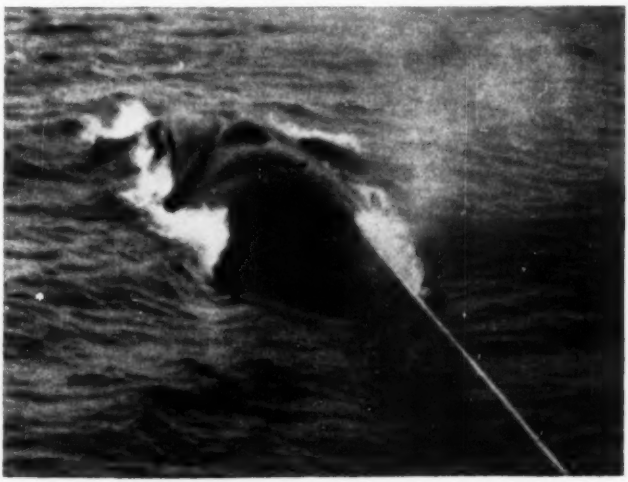

FIG. 8

The moment of impact: the harpoon strikes home in the back of a Blue whale. The angles of the jaws and the blow-holes can be seen. *(Photo W. R. C.)*

(Article by Cockrill, page 175)

PLATE III

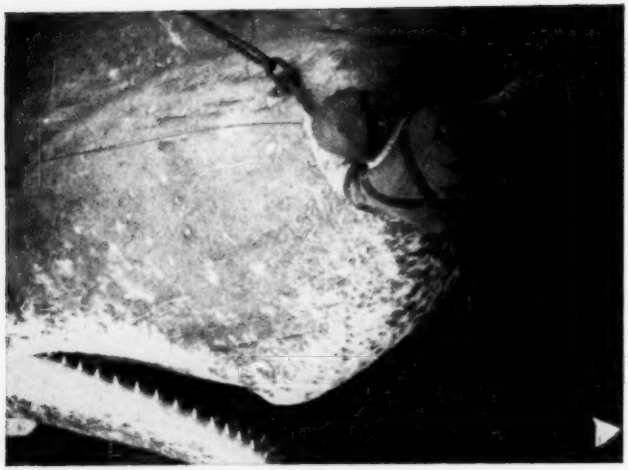

FIG. 9

The head of a Sperm whale.
(Photo C. E. Ash)

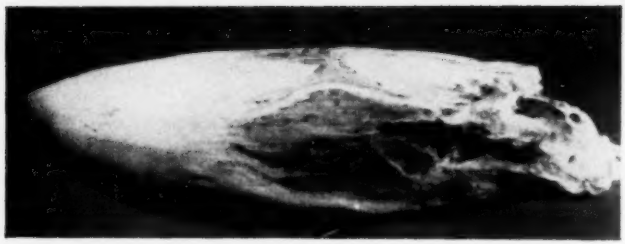

FIG. 10

Tooth of Sperm whale, showing extensive area of absorption following on abscess formation : approximately ¾ size.
(Photo W. R. C.)

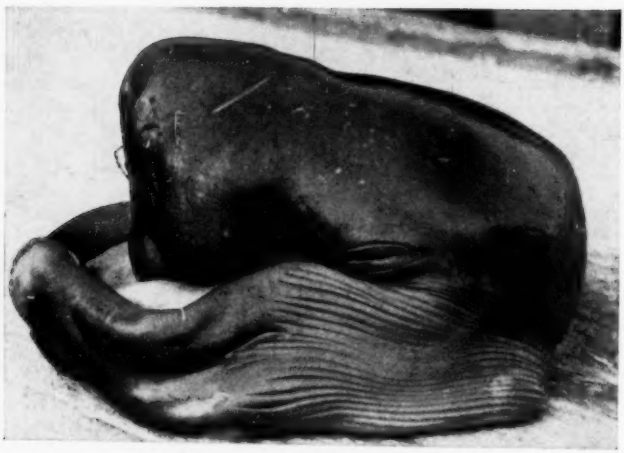

FIG. 11

Head of deformed Blue whale fœtus.
(Photo C. E. Ash)

Photos by C. E. Ash

(Article by Cockrill, page 175)

of absorption almost surrounds that part of the tooth below the gum. The gum tissue is normally very firm and hard, and closely invests the teeth, but damage caused in fighting or in feeding may allow the entry of bacteria and the initiation of inflammation. It is possible that such inflammation may also arise from damage caused by *Conchoderma* infestation.

There is no reason to regard the whale as a very long-lived mammal. It appears likely that a whale twenty years old can be classed as ageing. The tail flukes of the largest whales are always notched and grooved and their edges present a crenellated appearance. Popular whaling belief classes these marks as akin to the facial wrinkles in the aged human subject.

During collection of the pituitary body for therapeutic purposes ossification of the dura mater was observed on several occasions. As this was noted only in the longer whales, which are presumed on the available evidence to be also the older whales, it is taken to be a manifestation of age.

Bacterial Conditions

In the Antarctic pelagic seasons of 1947/48, 1948/49, 1949/50, and 1951/52, inspectorate staffs consisting, in all, of six veterinarians and eight lay meat inspectors examined some 12,000 whale carcasses without finding any evidence of specific disease. The species of whales represented in this total are Blue, Fin, Humpback, Sei, and Sperm, from all the permitted hunting areas in the Antarctic.

Investigations into the bacterial content of whalemeat have been carried out in one of the British expeditions (Case, 1948, 1949 ; Robinson, Pugh and Selbie, 1949 ; Robinson, Ingram and Eddy, 1952 ; Robinson, Ingram, Case and Benstead, 1953), and also in Northern waters at shore whaling stations in Norway (Ingram and Hauge, 1948). *Streptococci* and *Clostridia* are normal inhabitants of the intestinal tract of whales, and invasion of the musculature appears to take place during the later stages of the death struggle, or immediately after death, and to be facilitated by the extreme fatigue induced by the hunt and struggle. Further contamination may occur as a result of inflation of the carcase with compressed air to render it more buoyant, and also during removal of the meat from the carcass and its subsequent treatment. In general, the pathogenic significance of the bacterial load of sound, wholesome whalemeat is no greater than that of similar abattoir meat.

The whale, however, is a warm-blooded mammal and there is no reason why there should be immunity to bacterial infection of a local or general nature. As has been indicated in a previous communication (Cockrill, 1951), the nature of the whale's environment principally accounts for the freedom from disease. In the present paper only Antarctic conditions are being considered and, in Antarctic waters, these oppose infection by most of the normal routes. Infection by inhalation would appear to be impossible, and no inflammatory condition of the respiratory tract has yet been reported: this may be related to the fact that throughout the respiratory tract and in the lungs the lymphoid tissue is developed very poorly. Infection by ingestion of pathogenic bacteria appears unlikely in the case of baleen whales whose intake of krill is varied only by the occasional and accidental inclusion of small fish.

The protective nature of the blubber largely obviates infection by injection. Old harpoon wounds have been observed to contain pus. Necrosis is sometimes present. Occasionally the infection, as evidenced by pus formation, penetrates into the deeper layers of the blubber and may affect the musculature. On one occasion a fistula was observed. Smears from such lesions, examined microscopically, have revealed the presence of *Staphylococci.*

There is a persistent legend that whales suffer from a venereal disease. No evidence of this has been observed in the many whales subjected to veterinary examination. It is very unlikely that infection by coitus ever takes place.

Generalized disease, calling for rejection of the entire carcass, has been encountered only twice in those seasons under review. In both cases the whales affected were immature Fins: in both cases they were killed in the Weddell Sea area: and in both cases the cause of rejection was poor condition consequent upon the presence of large abscessed areas.

In the first instance (Cockrill, 1951) the whale exhibited the diatomaceous skin deposit already discussed. During removal of the back muscle a large abscess was revealed which extended from the second to the fifth lumbar vertebra. The abscess was situated ventrally, incorporating the substance of the bodies of the vertebrae. It contained a large quantity of fluid yellow pus. The affected bone was very brittle. There was no encapsulation. The muscle tissue in the vicinity was soft, light in colour, and it had lost some of its texture. The dorsal vertebral area was unaffected and no external injury could be discovered, though the character of the lesion would conform to the picture of the entry of infection from outside the body. There was an extensive chronic peritonitis. A thick mat of grey, fibrous material completely covered the peritoneum, the stomach, and the visceral surface of the liver. There were widespread and firm adhesions between liver and stomach, and between spleen and stomach, but the intestines were unaffected and the thoracic viscera were healthy.

The other case of generalized disease was reported by Addison (1950). This whale was thin to the point of emaciation. A huge abscess was present which involved a testicle and part of a kidney.

It must be borne in mind that this remarkable freedom from specific disease refers only to whales, of the above five species, which have actually been examined by veterinarians, or under veterinary supervision, on the decks of floating factories in the Antarctic whaling grounds. Disease may well exist without examples having been present in whales taken during the seasons under consideration. There may be transitory diseases, or there may be enzootic diseases, affecting whales in certain ocean areas only, occurring perhaps in tropical or sub-tropical waters, or being confined to whales in the earlier stages of development when they are still immature and are protected by the law.

It must also be remembered that the emaciated or ailing whale will, in general, be ignored by the gunners on the whale catcher ships in favour of mature whales in good condition. The weak or crippled whale will fall victim readily to such natural enemies as the voracious Killer whale. The sole defence of the

Baleen whale is his speed on the surface, in diving, and at depth, and any condition which would reduce this, or interfere with balance, buoyancy or locomotion, would render him liable to attack.

The examination of "*dauhvaler*" was expected to be a source of useful information on the occurrence of disease. A *dauhval* is defined by international agreement as "any unclaimed dead whale found floating." Eleven *dauhvaler* in all have been inspected by writer, the post-mortem period being estimated variously at from three to fifteen days. In every case the cause of death was harpoon wounds, the whales having either escaped during the struggle and died later, or having been lost during towage to the factory ship in stormy weather. No whale which has died from natural causes in the Antarctic has yet been examined for disease processes.

Heggenhaugen (1932) in an early example of veterinary activity in regard to the pathogenicity of whalemeat, described his investigations at a land station following many deaths on silver fox farms blamed on diseased or otherwise unsuitable whalemeat. He was unable to find any condition of the meat which could be considered responsible for the deaths. Aaser (1944) regarded the presence of bacteria in whalemeat as being wholly due to extrinsic causes, but he viewed the liver with suspicion and recommended measures of control in its use for human consumption.

Nielsen (1890) described a method of killing the whale *Balaenoptera rostrata* practised in the vicinity of Bergen for over 500 years. Arrows forged from a special iron were tipped with an inoculum obtained from dead whales, and were fired by means of a bow into whales which had previously been herded into a small bay. These arrows penetrated the blubber to enter the musculature. After 24-36 hours the affected whales became less lively and came to the surface more frequently. They were then harpooned and dragged ashore. At the site of entry of the arrows haemorrhagic infiltration was observed over a wide area, with gangrenous degeneration and the production of a great deal of gas in the tissues. The withdrawn arrow conveyed infection and was known as the "death arrow." The transmission went on from whale to whale for centuries and only ceased with the introduction of more efficient methods of killing. It appears that the local population ate this diseased flesh and no ill effects have been reported. It is, perhaps, analogous to the consumption of mutton from sheep which have died of Braxy. Such meat if obtained before an advanced state of putrefaction was reached, was at one time considered to be a delicacy.

Christiansen (1919, 1920), and Heller (1920), report the isolation of a bacillus from a piece of dried muscle thirty years old, secured and preserved by Nielsen about 1890. Christiansen found the organism to be highly pathogenic for laboratory animals. Intramuscular injection in a dolphin produced septicaemia and death within 20 hours, haemorrhagic inflammatory oedema and emphysema being present around the site of injection. Heller (1920) discussing the etiology of acute gangrenous infections of animals, regarded the bacillus as being of the *Vibrion septique* group.

Kawamura, Nagao, and Fukuyama (1925) isolated an anaerobe from the preserved muscle of a stranded whale in the Aomori prefecture in north-east Japan. At this period—1922—Blackleg (*sic*) in horses and cattle was stated to be very common in the district, where it had been known for about a century. Animals eating, or coming in contact with, stranded carcasses of Fin and Sei whales, were said to die from conditions resembling Rauschbrand. Laboratory animals were highly susceptible to this anaerobe which appeared to be of the *Clostridium* group.

Case (1948) found bacteria in the musculature of Antarctic whales soon after death, and he observed that putrefaction in whalemeat was coincidental with bacterial multiplication.

Rapid multiplication of bacteria takes place with the relaxation of rigor mortis. Bacterial counts in the liver are generally higher than those in the musculature. The bulk of the intrinsic flora of whalemeat are *Clostridia* and *Streptococci*, probably originating in the intestines. The liability of whalemeat to convey the food-poisoning bacteria does not exceed that of any other meat. Whalemeat does not differ from other meats in containing *Clostridia* capable of causing gas-gangrene. *Clostridium botulinum* has not been isolated from whalemeat. The pathogenic significance of the bacteria isolated from whalemeat as shown by the very exhaustive investigations carried out between 1946 and 1949 is no greater than that of other types of meat (Robinson, Ingram, Case and Benstead, 1953).

At varying times suspicion has f on whalemeat meal as a medium in the transmission to domestic animals o such diseases as Anthrax, Tuberculosis and Contagious Abortion. In the author's experience none of these conditions exists in the whale. There have been no reported cases, and it is extremely unlikely that any of these diseases would ever be found in whales. The nature of the environment largely precludes infection by Tuberculosis or Anthrax although the whale, being a mammal, is no doubt susceptible to infection under certain circumstances.

A great many female whales at all stages of pregnancy have been examined on the decks of factory ships. No evidence that would lead to a suspicion of Contagious Abortion infection has ever been seen. Abortions do occur in whales which are advanced in pregnancy. Such whales frequently lose their calves during the ultimate stages of the violent hunt and struggle. In the latter phase of the hunt the whale, as seen from the catcher, shows all the signs of terror. The track zig-zags erratically, they surface with increasing frequency, and a russet staining of the sea water may be seen as the contents of the lower bowel are voided. Extreme and prolonged fright and exhaustion together may, in the author's experience, induce abortion. It is common to find female whales in which no foetus is present but which exhibit all the signs of an advanced pregnancy. Slijper (1949) has commented on three such cases in Blue whales, and suggests that the abortion took place at the moment when the whale was struck by the harpoon.

That abortion does not occur readily is shown by the large number of foetuses at all stages of development which are observed on factory ships. Its occurrence

when pregnancy is well advanced can be accepted, but there has never been a suspicion that such abortions were due to bacterial infection.

Abnormalities of Pregnancy

Of the 350 Blue and Fin female whales killed in the Ross Sea area between 2nd January, 1952, when the Baleen season opened, and 31st January, 101 were pregnant. The largest Fin foetus observed was 5.5 metres long and the largest Blue foetus, 5 metres. No whale was observed in lactation during this period.

There is no reason why advanced pregnancy should militate against acceptance of the meat for human consumption. The meat must, in all cases, be judged on its merits. From the point of view of inspection and subsequent grading of meat, it is interesting to note that only a small proportion of the meat from pregnant whales is of top quality, the remainder being considered as suitable for manufacturing purposes only and as a constituent of prepared foods.

Calculations on the weights of Antarctic whales have been made by Ash (1952, et seq.), and Nishiwaki (1950), and weight data have been noted by Quiring (1943), but no attempt has been made yet to relate the weight of any individual organ to processes of a pathological or physiological nature.

During the season 1951/52 a series of detailed observations on liver weights was made by the author in collaboration with Mr. S. G. Brown of the National Institute of Oceanography. There appeared, on superficial inspection, to be a wide range in the size, and presumably also in the weight, of livers from whales of the same length and species. In view of the size of the liver—weights in the region of 920 kg. are of frequent occurrence—and also of the conditions on the floating factory during dismemberment of the carcase, it was not practicable to weigh the entire organ. However, as it is cut into pieces before being fed into the liver plant mincer, a series of weighings was made and an average weight for the liver pieces was calculated. Routine counting of the number of pieces per liver was then introduced, together with checks on the average already struck, and with these figures it has been possible to form an approximate picture of the relation of liver weight to whale species, sex, size and state of pregnancy. Average figures were calculated for the livers of Blue and Fin whales in foot/pounds units, in respect of males, non-pregnant females, and pregnant females, of each species. In both Blue and Fin whales, the livers of the males are slightly smaller than those of the females: while the livers of pregnant females appear to be slightly, but significantly, larger than those of non-pregnant wemales.

Further work on liver weights is required. It is sufficient to express here the writer's belief that the liver acts as a food reservoir, and that fat is laid down within the liver in much the same manner as it is in the blubber and mesentery, the reserves of fat in the livers of pregnant whales being significantly greater. It is suggested that future assessments should relate liver weights to blubber thicknesses over the period of the whaling season.

The histological picture of sections of liver from pregnant whales appears to substantiate a degree of fat storage in the hepatic cells greater than that found in males and non-pregnant females.

It is the author's belief that this pseudo-hypertrophy appears in the liver during pregnancy, and possibly also in the pituitary and adrenal glands, where apparent enlargement has been noted.

Malformations are frequently observed in the whale foetus. Attention is drawn to this condition owing to the fact that all female whales are examined on the factory deck for pregnancy and details concerning the foetus are recorded.

Abnormalities in the foetal development of whales have been commented on by numerous workers. Slijper in "Die Cetaceen" (1936), and in later publications (1949), draws attention to a variety of developmental abberations. Collett (1886) and Guldberg (1908) have also commented on foetal abnormalities.

The deformed head of a Blue whale foetus (Fig. 11) was photographed in the Ross Sea area. The foreshortened and bulky appearance of the skull gave rise to the erroneous belief that this foetus represented a cross between a Blue and a Sperm whale. The foetus appeared to be otherwise normal and was estimated to be at about the sixth month of development.

The tendency towards calcification of the abnormal lesion within the body of the whale is occasionally exemplified in the case of the foetus. If a dead foetus is retained within the uterus it frequently becomes calcified either wholly or in part. The formation of a small lithopaedion has been noted by Nishiwaki and Oye (1948) who also reported several other foetal abnormalities.

As Slijper (1949) has pointed out, the Cetacea and the Hippopotamus are the only mammals which give birth to their young in the water. Very few observations on the actual birth can, therefore, be made, but a large volume of data is forthcoming from the Antarctic factory ships which inevitably deal with many pregnant females. At birth, a Blue whale is approximately 7 metres in length. Twins are seen occasionally: triplets are observed rarely and exceptionally four or even more foetuses have been noted (Paulsen, 1929). In the Ross Sea area the writer noted twin male foetuses 2.41 metres long from a Blue whale 25 metres long; and twin male foetuses 1.5 metres long from a Fin whale 21 metres in length. In neither case were these identical twins.

Discussion and Summary

(*a*) A review is given of the etiology, course, and effect of the pathological processes in Baleen and Sperm whales as observed by the author in the Weddell Sea and Ross Sea areas during the course of two Antarctic pelagic whaling seasons. The original survey is amplified by references to appropriate literature.

(*b*) In view of the considerable importance of the whaling industry in adding to the available world food stocks for man and animals the public health aspect of such observation and investigation is stressed.

(*c*) Parasitic infestations of the Antarctic whales are considered, and the author's collections of internal and external parasites are described in relation to the lesions produced. Two new host records, and one species of parasite not previously described, were recorded.

(*d*) Tumours of whales are considered and the numerous specimens observed are described. Their benign and frequently retrogressive character is commented on.

(*e*) The formation of abscesses in muscle and other tissues is surveyed. Numerous specimens are described and their probable etiology is reviewed.

(*f*) Other lesions from whales in the Ross Sea and the Weddell Sea Antarctic whaling grounds are particularized, and the ready and abundant formation of fibrous tissue and calcification is considered as a characteristic response of the whale to injury or irritation.

(*g*) The traumatic lesions commonly encountered in whales are enumerated and reference is made to the sequelae of traumata, including caries and dental absorption in the teeth of Sperm whales.

(*h*) Bacterial conditions of whale tissues are surveyed, and the comparative freedom of the whale from specific disease processes is assessed. The possibility of the existence of other diseases, not so far recorded, is considered in the light of the author's observations and the extant literature. The nature of the whale's environment in relation to the infrequency of bacterial infection is discussed.

(*i*) Some abnormalities and malformations of the whale foetus are chronicled, and the incidence of multiple pregnancy is noted.

(*j*) The paper is illustrated by numerous photographs, and a detailed bibliography is appended.

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MORPHOLOGICAL STUDY ON DICTYOCAULUS ARNFIELDI (COBBOLD, 1884) RAILLIET AND HENRY, 1907, FROM A DONKEY IN EGYPT

By K. N. SOLIMAN, Ph.D., D.V.M. & S.,

Veterinary Research Institute, Ministry of Agriculture, El Dokki, Giza.

Cobbold (1884) created the species *Strongylus arnfieldi* to hold a lungworm which he found affecting the lungs of a donkey in 1882. Railliet (1895) reported this parasite affecting the horse. Raillet and Henry (1907) founded the genus *Dictyocaulus* and transferred to it *Strongylus filaria* as the type species, *Strongylus viviparus* and *Strongylus arnfieldi*. Dikmans (1936) and Dougherty (1946) carried out a survey study reviewing members of this genus and both considered *D. arnfieldi* a valid species. The latter author stated that this parasite was confined to hosts belonging to the order *Perissodactyla*, the family *Equidae* and the Indian tapir. LaPage (1956) considers that the donkey is the usual or natural host of this parasite and that it may act as a reservoir of infections in other *Equidae*.

Cameron (1933) mentioned that *D. arnfieldi* is distributed in Europe, United States, India, Australia and Argentina. Dikmans (1945) reported it from North America.

Cameron (1926) recorded a morphological study of this parasite in England and reported on the biology of its infective third stage larvae. Baker and Güralp (1957) reviewed the subject and reported on the morphology of *D. arnfieldi* which they collected from the respiratory tract of a dead pony and found two more alive infected cases in a live pony and a donkey in the United States of America.

As far as the Egyptian Region of the United Arab Republic is concerned, Zafer and Abdou (1957) reported this parasite affecting donkeys and horses, but gave no description of the parasites they diagnosed.

The purpose of this paper is to put on record the morphological characteristics of *D. arnfieldi* recovered from a donkey which died on the 29th April, 1956, as well as to describe abnormalities observed in the rays of bursae of the males collected.

History of the case.—A donkey, 4 years old and suffering from colic, had been referred to the Large Animal Clinic, University of Veterinary Medicine, Giza, towards the end of March, 1956. A history of chronic harsh cough for some months before the sudden onset of the colic symptoms was given. The animal died two days later. The clinical diagnosis of intestinal obstruction was verified by the finding, at the examination post-mortem, an incarceration of a part of its intestines in the Foramen of Winslow. Chronic bronchitis was observed also and when the bronchial tree was opened a large number of lungworms were revealed. These proved to be *D. arnfieldi*.

Material and Methods

The material collected when the donkey was examined post-mortem comprised the frothy mucous containing new-shed eggs and the hatched first-stage larvae as well as the mature fifth stage of *D. arnfieldi*. With a hand lens, observa-

tions on the orientation of the adult parasites, mainly those clogging the smaller bronchioles, were recorded. Thirty-seven males and 68 females were collected in normal saline. Some parasites were examined in the fresh state to determine the species and the rest were fixed in hot 70 per cent. alcohol containing 5 per cent. glycerine. For detailed study of their morphology, specimens were cleared in lacto-phenol and rolled under 2″ x $\frac{7}{8}$″ No. 2 coverslips to demonstrate the different organs.

Results

Orientation of D. arnfieldi in the Bronchial Tree of the Donkey

Examination of the parasites *in situ* showed that they lie with their heads facing the terminal branches of the trachea and with their tails pointing towards the main trunk of the bronchial tree. The inflammatory process caused by the presence of these parasites provoke coughing efforts so that the host can rid itself of the accumulated exudate in their bronchi. With each cough the parasites are driven towards the pharynx and to evade displacement they wriggle down in the opposite direction. In doing so, the parasites face the stream of the inflammatory exudate upon which they feed. It seems that this particular pattern of orientation adopted by these parasites is a normal phase of their feeding complex. Soliman (1951 and 1958) recorded similar findings as regards *D. filaria* in sheep. *D. viviparus* in cattle and camels, and *Metastrongylus apri* in pigs.

Morphological Study on Dictyocaulus arnfieldi

The Ova: The ovum, when laid, contains a living embryo ready to hatch. The embryos in the newly-deposited eggs are within two coverings transparent to transmitted light. They consist of an outer elastic comparatively thick covering and an inner thin intact vitelline membrane. These two coverings could be demonstrated also in eggs from the uteri. Measurements of 15 eggs gave a range of 85 to 95 by 50 to 60 microns.

First Stage Larvae: Measurements recorded from 20 larvae ranged from 290 to 390 microns in length by 15 to 17 microns in width. They have already well developed oesophagi which could be readily seen at that early stage in contradistinction to those of the other two species, namely, *D. filaria* and *D. viviparus*. The larva in *D. arnfieldi* differs from the corresponding stages of the last-mentioned two species in having a caudal vesicle at the tip of its tail giving it the shape of a spear, the head of which is formed by this vesicle.

Mature Adults of D. arnfieldi: Males of this species share the general features of the other allied members of the genus in being white in colour and usually they are smaller than the females. Thirty-five specimens of each sex were chosen at random for this study. The males measured 35 to 43 mm. in length by 180 to 259 microns in breadth. The females measured 45 to 65 mm. long and 400 to 500 microns broad and the distal end exhibited a tapering fashion similar to other allied species of the genus.

Buccal Capsule and Oesophagus: Both sexes possess a shallow buccal capsule leading to a club-shaped muscular oesophagus. The buccal capsule measured 20 to

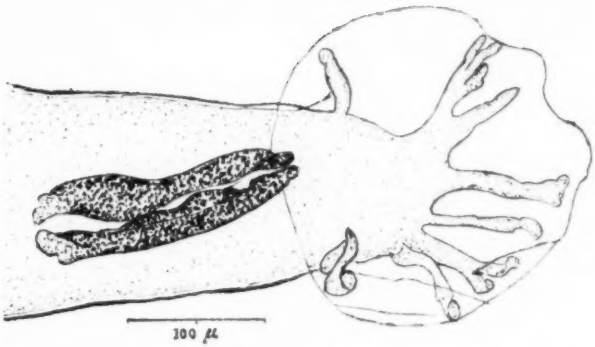

FIG. 1

D. arnfieldi bursa, ventro-ventral ray seems to be missing or altogether fused with the observed latero-ventral ray. The antero-lateral ray has a common trunk with the other laterals. Externo-dorsal ray has a common trunk with the lateral group. Medio-dorsal seems to be missing or fused with the externo-dorsal. All abnormalities were in the left side only. Ventral view. Camera lucida tracing.

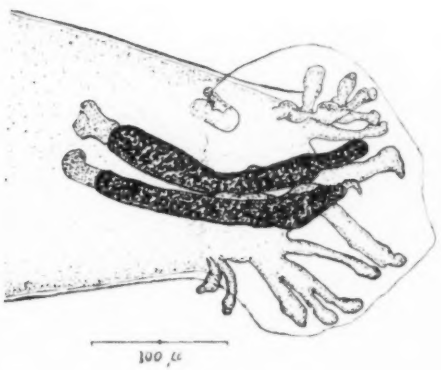

FIG. 2

D. arnfieldi bursa, ventral view showing the antero (externo)-lateral having a common trunk with the other two laterals in the right side of the bursa. Camera lucida tracing.

(*Article by Soliman, page 191*)

PLATE V

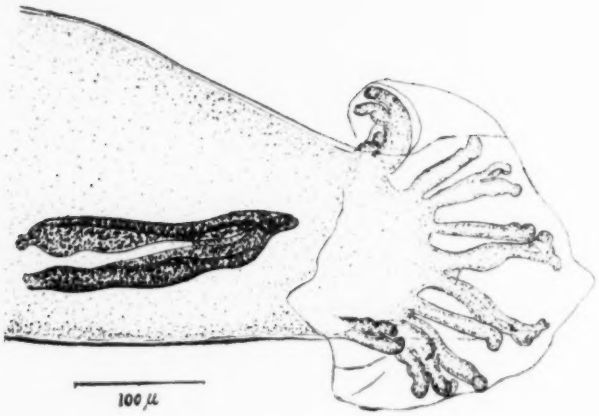

FIG. 3

D. arnfieldi bursa, ventral view, showing the antero (externo)-lateral having a common trunk with the other two laterals in right side of the bursa. Camera lucida tracing.

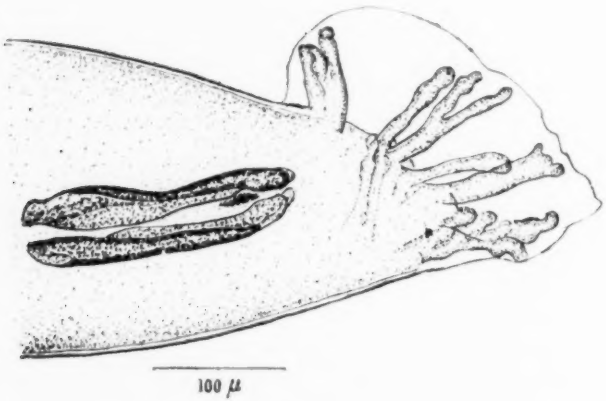

FIG. 4

D. arnfieldi bursa, lateral view, showing the normal features of the rays. Camera lucida tracing.

(Article by Soliman, page 191)

26 microns in width and 23 to 30 microns in depth. The length of the oesophagus ranged from 500 to 750 microns.

Nerve ring and Excretory pore: The nerve ring was located at the middle of the oesophageal length with the excretory pore just behind it.

Genital System: The genital system is single and is similar to that in other species of this genus.

The Bursa and its Rays: The bursa copulatrix is not lobed and the rays supporting its structure are blunt pointed and sharply divided into ventral, lateral and dorsal groups.

The Ventral Rays: In all the 35 specimens examined, these were observed to have a common trunk formed by the joining of both their stems. The ventro-ventral ray was observed to be always slightly shorter than its accompanying ray. An abnormality of this ray was observed in the left side of the bursa in one specimen, where only one ray was seen. Judging by its length and comparing it with the right side, it seems as if the ventro-ventral ray is missing or has been fused with the observed latero-ventral ray (see Fig. 1).

The Lateral Rays

The Antero (Externo)-Lateral Ray: In all the specimens examined, with the exception of three, this ray was separate from and ran close to the other two rays of this group. It is slightly shorter than them. In two of the specimens it was observed to have a common trunk with the other two rays on the right side of the bursa (see Figs. 2 and 3). This fusion was more pronounced in the right side of the specimen shown in Fig. 1.

The Medio and Postero (Dorso)-Lateral Ray: In the majority of the specimens examined these two rays were fused together for more than half their lengths with the postero dorso-lateral being slightly longer (see Figs. 4, 5 and 6). Abnormalities to this rule were observed in 3 specimens. In the specimen drawn in Fig. 1, the trunks of these two rays were fused with that of the previously described ray on the left side of the bursa. In the second specimen both rays, instead of having their trunks fused for the greater part of their length, were separate and ran close to each other only on the left side of the bursa (see Fig. 7). The third abnormality is shown in Fig. 8, where the two rays were fused almost completely with only a blunt end denoting the existence of the medio-lateral. This abnormality was observed in the right side of the bursa.

The Dorsal Rays

The Externo-Dorsal Ray: The externo-dorsal ray arises separately to the outside of the medio-dorsal ray. Usually this ray has been observed to be a little shorter than the medio-dorsal one. Three specimens exhibited abnormalities of this ray. The first was observed in the left side of the bursa in the specimen drawn in Fig. 1, where it looked as if it has a common stem with the lateral rays. In the second specimen the ray in the right side of the bursa was missing (see Fig. 5). In the third specimen this ray was fused with the left medio-dorsal forming one ray and they separated only at their ends. This last abnormality was observed only on the left side of the bursa (see Fig. 8).

The Medio-Dorsal Ray: In all the 28 normal male specimens examined the medio-dorsal rays were observed having a common stem for one-fourth to less than half their relative lengths. The two divergent separate parts looked like an inverted V-shape with the base towards the end of the parasite and the two arms supporting the bursal structure. In the eight specimens drawn (Figs. 1 to 8) the medio-dorsal rays of both sides united only at the base of their stems. In Fig. 6 they even looked as if they arose separately with the ray in the left side fusing with the externo-dorsal one. In the specimen shown in Fig. 1 the left medio-dorsal ray appeared to be missing.

Each ray ended in a short finger shaped process which in the majority of the specimens examined displayed two or three projections varying considerably in their terminal arrangement. This feature is in agreement with that recorded for *D. viviparus* Dikmans (1936) and Soliman (1958 & 1959).

Spicules and Gubernaculum: The spicules are two in number, of reticular honey-comb structure, brown in colour and are applied closely to each other. A small rudimentary gubernaculum is always present. Measurements of these organs were found to be:—

Spicules, length ranged from 199 to 260 microns.

Gubernaculum, length ranged from 40 to 57 microns.

The Vulva and its position: Position of the vulva in the 35 female parasites examined was found to be just in front of the middle point of the body by a distance that ranged from 0.5 to 4 mm. in the longest parasite which was observed.

The Position of the Anus: The anus was located at 380 to 450 microns from the bluntly pointed end of the females.

Anal Papillae: A pair of small anal papillae, not projecting beyond the cuticular margin, were observed. These were located at a distance ranging from 100 to 130 microns from the end of the tail.

Discussion

Cameron (1926) mentioned that *D. arnfieldi* frequently causes no symptoms and that its presence could be missed for this reason. It is possible that the coughing efforts, provoked by the parasitic infection, helped the occurrence of the intestinal incarceration. The intestinal incarceration leading to the death of the animal might have masked the parasitic infection which the systematic examination post-mortem revealed.

The pattern of orientation *D. arnfieldi* acquired in the bronchial tree of the affected animal is in agreement with what has been described for *D. filaria* in sheep, *D. viviparus* in cattle and camels, and *Metastrongylus apri* in the pig Soliman (1951, 1958 & 1959). The morphology recorded for *D. arnfieldi* in this study agrees fundamentally with that given by Cameron (1926) and Baker *et al.* (1957). Abnormalities recorded occurring in 7 specimens are analogous to what has been met with in *D. viviparus* Soliman (1958 & 1959).

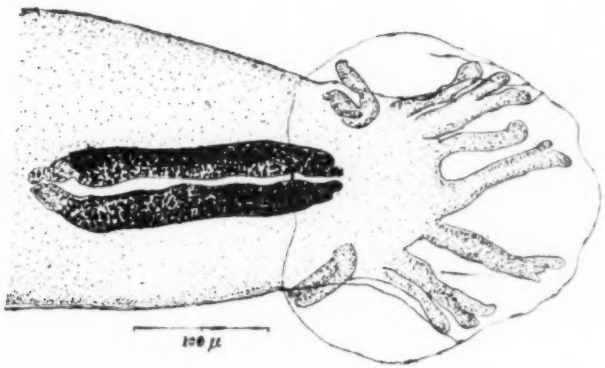

FIG. 5

D. arnfieldi bursa, ventral view, showing the externodorsal ray of the right side missing. Camera lucida tracing

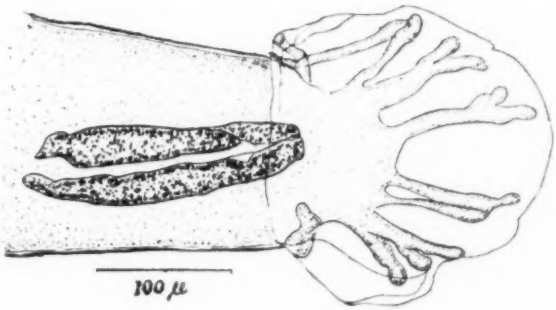

FIG. 6

D. arnfieldi bursa, ventral view, showing the externo-dorsal ray of the left side fused with the medio-dorsal of that side. Camera lucida tracing.

(Article by Soliman, page 191)

PLATE VII

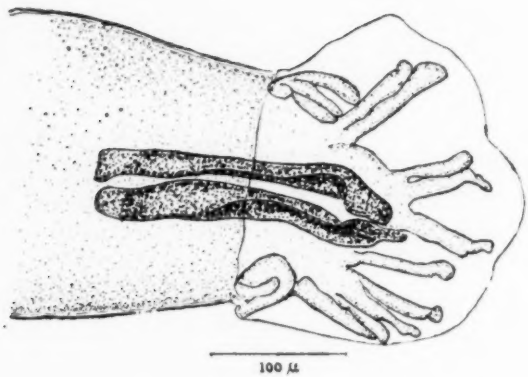

FIG. 7

D. arnfieldi bursa, ventral view, showing the medio and postero-laterals in the left side not uniting in their trunks but running close to each other. Camera lucida tracing.

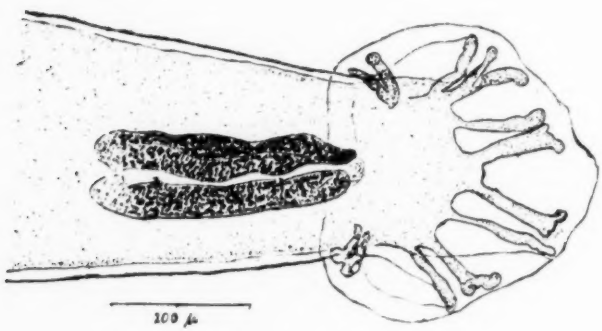

FIG. 8

D. arnfieldi ventral view showing the medio and postero-laterals fusing together completely except the tip of the rays. Camera lucida tracing.

(*Article by Soliman, page 191*)

Summary

1. A case of parasitic bronchitis caused by *D. arnfieldi* in a donkey is described.
2. A morphological study of the ova, first stage larva and mature adults is recorded.
3. Observations on the orientation of *D. arnfieldi* in the bronchial tree of the affected animal are given.
4. Abnormalities in the bursal rays are described.

Acknowledgment

The author wishes to express his thanks to Dr. G. Tadros of the parasitological section, Veterinary Research Institute, Ministry of Agriculture, Egypt, for his willing help in preparing the camera lucida drawings.

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NODULAR LESIONS IN THE OMENTUM OF GOATS

By A. N. TEWARI and P. K. RAMCHANDRA IYER,

Disease Investigation Section, Indian Veterinary Research Institute, Izatnagar, U.P., India.

A peculiar nodular lesion has been encountered in the omentum of several healthy goats slaughtered for collection of spleen in the manufacture of rinderpest goat tissue vaccine at this Institute. The same condition has been found also amongst goats examined *postmortem* in the course of other work. It remains to be ascertained whether this condition occurs in other parts of the country.

Gross Appearance

The lesion appears as a pedunculated mass attached to the omentum by means of a pedicle and it hangs freely in the peritoneal cavity (Fig. 1). The pedicle has a twisted spiral appearance and, on histological examination, it is found to consist of fibrous connective tissue supporting blood vessels. Animals of both sexes are affected equally. The mass may be oval, conical or globular ; a few were quite irregular ; they vary from 0.1 g. to 13 g. in weight. The cut surface resembles a lymph node or it may appear as a caseous mass with large areas of calcification which are difficult to cut with a knife. On section, one nodule showed areas of yellowish pigmentation distributed throughout the substance. Otherwise the growth is white in colour and smooth in texture with areas of calcification, depending upon the age of the growth.

Microscopic Appearance

Nodular lesions with the attached omentum were collected in 10 per cent. formol saline and sections cut at thicknesses varying from 5 to 10 microns, depending upon the extent of calcification. The sections were stained with Mayer's haematoxylin and eosin, von Kessa's method for calcium and van Gieson's picrofuschin for connective tissue.

Histologically, the growth shows a well-developed fibrous capsule surrounded by serosa of the omentum (Fig. 2). In old lesions the serous coat is absent. Immediately underneath the fibrous capsule and often adherent to it in fairly old lesions there is a thin layer of calcification (Fig. 3). The latter can be demonstrated by von Kossa's method of staining. The remaining part of the lesion presents a picture composed of closely packed and large-sized cells, either pear shaped or polyhedral in outline (Fig. 2). In sections stained with haematoxylin and eosin the cells appear as empty spaces with flattened nuclei at the border of the individual cell.

In older nodules, nuclei cannot be recognised due to advanced degenerative changes. In long-standing cases, the empty spaces contain calcium soaps in granular form, while the septal walls are infiltrated with large amounts of calcium (Fig. 4). In one specimen only, the lesion contained, in addition to calcium, greenish-

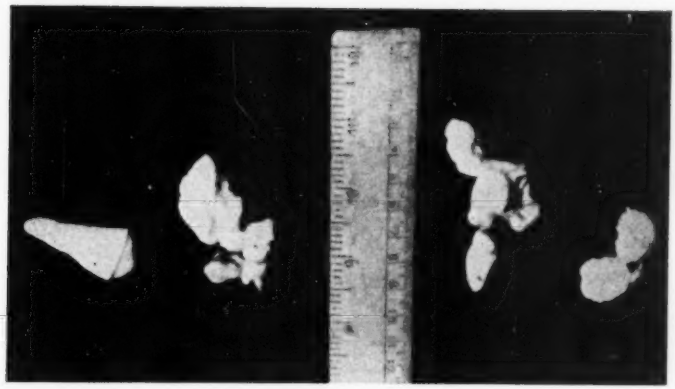

FIG. 1

Gross lesions with the attached omentum.

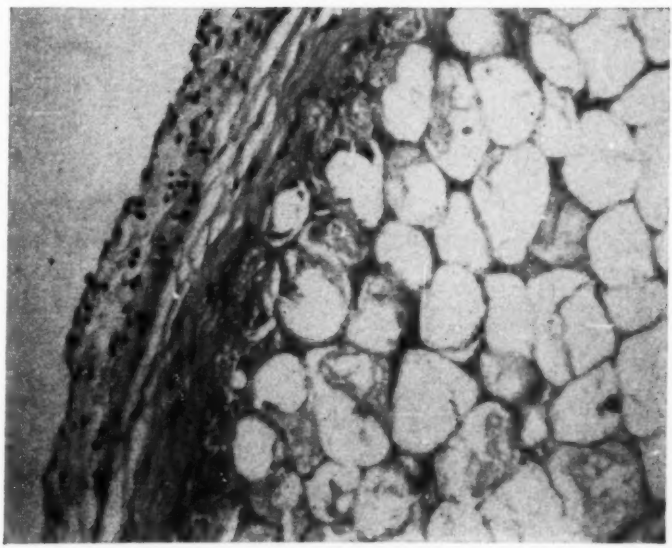

FIG. 2

Early nodule showing serous coat, fibrous tissue capsule and septal spaces containing calcium soaps. Haematoxylin and eosin x 500.

(Article by Tewari, page 196)

PLATE IX

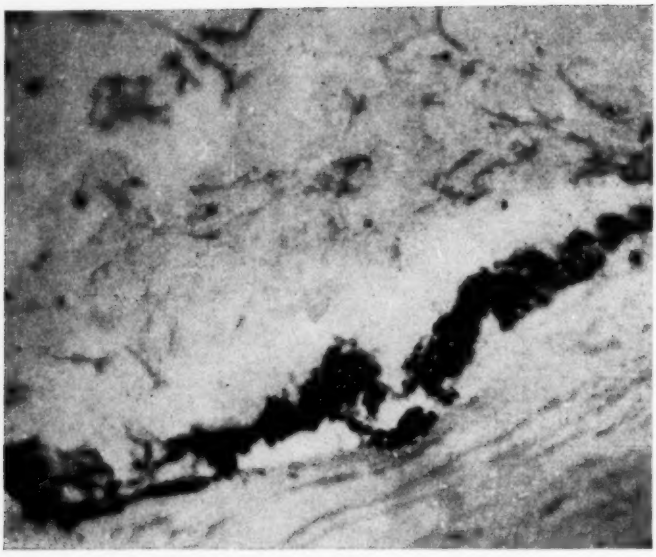

FIG. 3

Late nodule showing fibrous connective tissue capsule and calcified layer attached to it. van Kossa x 750.

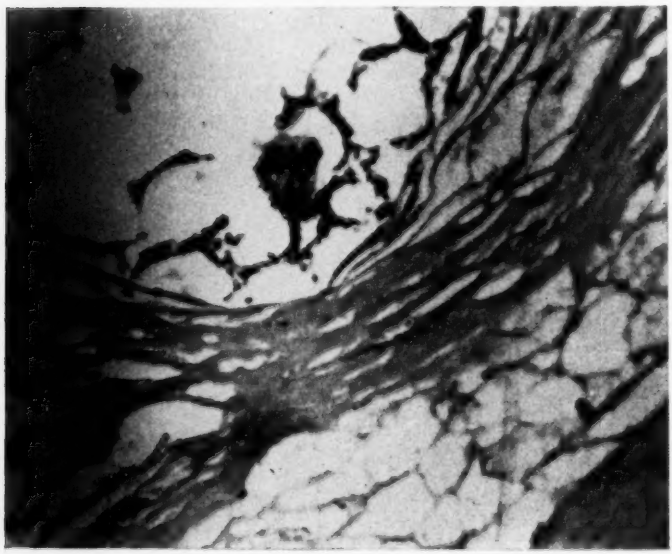

FIG. 4

Old nodule with fibrous coat and septal walls converted into calcified areas. Haematoxylin and eosin x 500.

(Article by Tewari, page 196)

yellow pigments both within the empty spaces and in the septal wall ; these were identified by histochemical stains as bile pigments.

Discussion

The lesions were confined to the omentum of goats ; other organs in the abdominal cavity, including the mesentery, were free from such growths. They were not encountered in sheep.

Two possibilities are presented as to their nature. The lesion may have started as a hydated cyst or it may be a lipoma of the omentum. A number of observations fail to support the former possibility, the most important of them being the histological appearance of the lesion which reveals no debris of the degenerating larvae of the parasite. One would not expect to find the pedicle of the lesion originated in a hydated cyst. The finding of these lesions in goats and not in sheep so far may also be against the growths having a parasitic origin.

That the growth is neoplastic in origin and a lipoma of the omentum is supported by the histological findings of fat-laden cells having all the characteristics of immature adipose tissue. Feldman (1932) holds the opinion that neoplasms are infrequent in goats and in his collection of about 550 neoplasms of domestic animals one only was found in the goat, and this was not a lipoma. Cotchin (1956) in his review on neoplasms of the domesticated mammals has not mentioned a single case of lipoma in the omentum of goats. The present findings, however, indicate that it is possible that lipomas may occur in the omentum of goats and, because of their situation in loose structures, torsion of the peduncle may occur ; the consequent stoppage of blood supply to a growing tumour may result in degenerative changes.

The yellow colouration in one of the nodules may have been caused by the diffusion of bile owing to its proximity to the gall bladder. Deep yellow colouration of part of the omentum lying close to the liver and gall bladder was observed in many goats, and it is quite likely that in this particular animal the yellow-stained part of the omentum might have been the site of tumour formation.

Summary

A peculiar pathological condition of the omentum of goats characterised by nodule formation has been recognised. The histopathology and the nature of this condition has been discussed.

Acknowledgment

Thanks are due to Mr. P. G. Pande, M.Sc., M.R.C.V.S., Director, Indian Veterinary Research Institute, Izatnagar, for providing all laboratory facilities and for his keen interest in this work.

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REVIEWS

THE VETERINARY ANNUAL. Edited by W. A. Pool, M.R.C.V.S. Bristol: John Wright & Sons Ltd. 42/-.

No veterinary surgeon, be he a practitioner or research worker, can keep entirely abreast of all the subject matter which comes within the sphere of his work. The wealth of new information which is being published constantly would make this an impossible task even for those who are privileged to have a complete library and reference service at hand. It has become difficult even for those who work in a specialised and restricted field to keep pace with the spate of new information concerning their own particular discipline.

This fact has been recognised for a long time in the sister profession of human medicine, and in that case such books as "Recent Advances" have served a very good purpose. The principle behind the idea is that authors, who are recognised as authorities in their own particular sphere, should summarise the latest information anent their own discipline and make the cogent facts available to the profession at large and by quoting the important references ease the task of those who desire to delve deeper.

It is for these reasons that we welcome the first issue of the Veterinary Annual.

There are a series of special articles covering veterinary work in many parts of the world, country practice in Britain, Horse Practice, Greyhound Racing and small animal practice. Following these current literature is reviewed. The topics range over a wide field covering almost every avenue of veterinary endeavour and in each instance the information is given by one of competent authority.

The final pages are devoted to new pharmaceutical, dietetic preparations, and medical and surgical appliances, and this information must be of great value to those who practise in the field.

The index facilitates ready reference and the illustrations are chosen well.

A book such as this needs a general editor. In choosing W. A. Pool the publishers could not have put the task in better hands.

This book should be in every veterinary surgeon's and every veterinary student's library and we look forward with keen anticipation to the future issues of this annual.

SOIL, GRASS AND CANCER. André Voisin. London: Crosby Lockwood & Son Ltd., 30/-.

The problem of cancer, one of the scourges of mankind, remains unsolved. Great advances have been made in respect of the treatment of recognised cases and in many instances, if manifest signals are given when the disease is in its early stages, a cure can be effected.

Good as this may be it is like shutting the stable door after the horse has escaped. Cancer will be conquered completely when we know more of its etiology and positive steps can be taken to prevent invasion. It is known that certain chemical substances possess carcinogenic properties and they can give rise to tissue reactions which are precursors of new growth. There are many who think that the key to the origin of cancer may be found in nutrition. It may be that a want of balance in minerals or vital food factors play an important role in the onset of this fell disease.

It may be that the secret rests in the soil and also in the way that soil is fed and stimulated for all food be it of animal or vegetable origin has its genesis in the soil. Andre Voisin is a distinguished French veterinary surgeon somewhat of the same school as our own Sir Albert Howard and Sir Robert McCarrison and he evidently believes that the secret lies in the soil and its management.

The ground that he has covered in this book is enormous. The literature

that he has consulted is terrific in amount. His exposition is clear and concise and every one of the 66 short chapters are pregnant with interest. The Bibliography is an indication of the wide field that he has scoured. This is a book that makes one sit back and think and having thought one instinctively turns to it again. It is not a book that one scans and then puts on a shelf and forgets but one which you are enticed to keep handy on the table or desk. It intrigues the mind with the idea that somewhere within the information laid forth in those 66 short chapters may rest the secret that we all desire could be disclosed.

BRUCELLA INFECTION AND UNDULANT FEVER IN MAN. By Sir Weldon Dalrymple-Champneys, Bt. 16 tables. Oxford University Press. 25/-.

An account of *Brucella* infection in man, in a book of moderate size and cost, is welcome. No story of *Brucella* infection is complete without reference to its ætiology, pathology and epidemiology ; this includes a discussion on the origins of infection and the nature and characteristics of the infecting organisms. Furthermore, it is inevitable that the pathology of disease underlies its clinical symptoms, diagnosis, prevention and treatment. The epidemiology of undulant fever embraces comparative pathology and comparative medicine and for this alone the book is of veterinary interest.

The author has had a wide experience of the disease and has used 1,500 indigenous cases, excluding laboratory infections, as a clinical basis of the book. The literature on the subject is voluminous and the author, because of his personal knowledge of the disease, has been able to select a bibliography of 385 references. These books and papers give a reader the opportunity to delve more fully into aspects which cannot be dealt with adequately for lack of space.

The author is to be congratulated ; he has achieved what he said he wanted to do in the preface ; he has the realistic and sensible outlook when he says " No longer can we regard a potentially pathogenic micro-organism as an enemy to be cast out root and branch whatever the cost, but rather is infectious disease to be regarded as due to a disturbance of the host-parasite relationship, so that the object of treatment is rather to establish or re-establish a ' comfortable symbiosis ' than to eradicate the parasite at any cost, a cost which may include permanent injury to or even death of the patient."

This book can be recommended to physicians, veterinary surgeons and to all those who regard this disease as one which is not basically confined to man or a particular animal species. Its epidemiology is a fascinating story ; its pathology is an excellent model for those infections characterised by intracellular parasitism. A readable account is therefore worthy of study by all who are interested in natural history, infectious disease and the welfare of man and his animals.

PATHOLOGISCHE HISTOLOGIE. Professor Dr. G. Pallaske. Jena. Gustav Fischer.

One of the most important features of this first-rate textbook of histopathology for veterinary students is a series of 546 illustrations. Most of them are drawings, many are coloured. These are of great clarity and can be of tremendous help to the student when he attempts to interpret what he sees under the microscope. There are a number of photomicrographs also — one or two are not too clear. One might say that the pictures in this book provide a very valuable illustrated survey of the common and important histopathological conditions encountered in veterinary pathology. The accounts of the histopathological changes illustrated are very lucid and they include sufficient relevant information concerning aetiology, pathogenesis, morbid anatomy, and sequelae to clarify and enhance the significance of the histopathological features described.

Most of the material in the book deals with the histopathology of organ systems, but there is a section devoted to inflammation and the neoplasia.

The author did not intend to give an exhaustive and minute account of every known histopathological change that may affect the organ system of animals—even so the coverage is very wide. What the author has done and in an excellent manner is to give careful detailed accounts of the really characteristic lesions. The book will be of prime interest to the veterinary student in his pathology course, but it would also be of interest to practising pathologists, whether veterinary or medical.

The production is of the high standard one expects of the publishers, and the text is very free from printing errors: some are noted in a correction slip in the book. The reviewer has noted that the names of the following are spelt incorrectly: Shope (p. 137), Fankhauser (p. 386) and Hangartner (p. 448).

It is a matter of regret that this excellent book is not available in the English language. Students who are familiar with German should certainly study it and those who are not conversant with the language can derive benefit from looking at the illustrations.

BEEF PRODUCTION. Bulletin No. 178 of the Ministry of Agriculture, Fisheries and Food. Price 5/-.

This is one of the series of Bulletins produced by the Ministry of Agriculture, Fisheries and Food and deals with all the main aspects of rearing cattle for beef production. It gives a general background to the subject and then deals with the suitability of different breeds, the principles of nutrition and growth, and the practical details of management, under different systems, from birth to slaughter: there is also a short section on diseases of calfhood. The Bulletin is very clearly written and gives facts and figures whenever necessary so that it would be possible for a farmer contemplating beef production for the first time to make a reasonable estimate of the necessary outlay and possible return. In fact, the Bulletin is so clear as to make the enterprise seem almost deceptively simple, and it is only the occasional phrase like "It is essential to keep the beasts content," that enables one to realise why some farmers are more successful than others in beef production, given comparable land.

In the early pages it would be helpful if references to plates were accompanied by an explanation that the plates are grouped together between pages 32 and 33. The elastic band method of castration is given, together with two older methods, but no mention is made of the controversy as to its humaneness or of the risk of tetanus infection associated with it. The construction and lay-out of yards is considered in detail, but the difficulties of fencing pastures and the possible use of electric fencing are not mentioned. The plates and figures are good and I found only one misprint of any importance—on page 73 when benzene hexachloXide instead of benzene hexachloride is advocated for the treatment of lice.

This Bulletin would be of great assistance to anyone contemplating beef production for the first time, and it would give an excellent picture of this aspect of farming to veterinary students who have not had first-hand experience of it in their vacations, or to veterinary surgeons who may wish to increase their knowledge of this type of animal husbandry.

NEWS & NOTICES

FEEDING OF ANTIBIOTICS TO FARM ANIMALS

The Agricultural and Medical Research Councils have set up a Joint Committee to examine the possible consequences of the feeding of antibiotics to farm animals and to consider whether this use constitutes any danger to human or animal health. The Committee will make such recommendations to the two Councils as may be thought necessary and its report will be made available through the Councils to the Ministers concerned.

The Lord Netherthorpe, a member of the Agricultural Research Council, has accepted an invitation to act as Chairman and Professor A. A. Miles, C.B.E., the Director of the Lister Institute of Preventive Medicine, has agreed to take the chair of a scientific Sub-Committee which will examine the evidence in detail and place its findings before the main Committee.

Apart from medical and veterinary scientists, the membership of the Committee includes farmers and experts in animal nutrition.

BRITISH SHEEP VACCINES FOR NEW ZEALAND

En route to New Zealand are two large consignments of Glaxo pulpy kidney and tetanus vaccines, the largest-ever order that the Company has received from the Antipodes for sheep vaccines.

The first shipment, sufficient to inoculate half-a-million sheep, was of saffelin, which gives protection against pulpy kidney disease alone ; the second batch comprised saffelin-T, a combined pulpy kidney-tetanus vaccine.

Vaccination against pulpy kidney is a well-established practice in New Zealand. Use of a combined pulpy kidney and tetanus vaccine is a new trend and this shipment of saffelin-T is thought to be the first to New Zealand.

The incidence of pulpy kidney disease in the island territories is similar to that of Britain, with a mortality of something like five per cent. Loss to New Zealand farmers, however, is much greater with their larger flocks.

SUPPLIES OF MALLEIN

As from 1st May, 1960, tthe production and supply of mallein by the Department of Medicine, Royal Veterinary College, will be discontinued. On and after that date mallein will be obtainable by veterinary surgeons from the Central Veterinary Laboratory, Ministry of Agriculture, Fisheries and Food, New Haw, Weybridge, Surrey. The charges will be 3s. 0d. per c.c. of concentrated mallein and 2s. 6d. per 5 c.c. of diluted mallein. Requests for supplies should be addressed to the Secretary, Weybridge Laboratory, as above.

NEW PRODUCTS

CIBA Laboratories Limited announce the introduction of Vetidrex, a new highly-effective diuretic for the treatment of udder oedema. Vetidrex (hydrochlorothiazide, a product of CIBA research), is non-mercurial and well tolerated. It may be administered by intravenous or intramuscular injection. Other oedamatous conditions which respond well to Vetidrex include: Chronic or pathological udder oedema in dairy cows, vulval oedema ; leg oedema (peritarsitis) of advanced preg-

nancy in elderly deep milking dairy cows ; oedematous wound swelling following surgical interventions, such as Caesarean section, rumenotomy ; inflammatory conditions of connective tissue ; oedema of the sheath (preputial oedema) in horses ; swelling due to insect bites and stings ; bowel oedema of piglets (aged 8 to 12 weeks, as an adjunct to specific treatment).

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Burroughs Wellcome & Co. announce the introduction of 'Leptovax-plus' brand Combined Leptospira Canicola Vaccine and Leutospira Icterohaemorrhagiae Vaccine for active immunisation of dogs against leptospirosis caused by L. canicola and L. icterohaemorrhagiae. The vaccine is issued in packs containing one immunisation course.

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A small number of blocks illustrating articles are normally paid for by the Journal. Authors may, however, be required at the Publisher's discretion to contribute towards the cost of these in cases where this is particularly heavy.

Some reduction is necessary in practically all cases and the numerals and legends on charts, diagrams, etc., should be much bigger and bolder than normal type so as to be sufficiently clear when reduced for reproduction.

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